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MOLD YOUR OWN GLASS PARTS

MODEL Airplane NEWS

9 ENGINES UNDER $100 DYNO-TESTED!

WHICH .40 IS BEST?

page 42

GREAT PLANES
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Electric-tech showcase
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TIGER MOTH 52-inch barnstormer · **PLEASER 2** Backyard electric twin
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MODEL Airplane NEWS

MARCH 2001 • VOLUME 129, NUMBER 3

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ON THE COVER: *main image—Great Planes' AT-6 Texan ARF on the wing; inset—Keith Shaw's Fokker D-VIII puts on a demo flight at NEAT Fair 2000.*

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EDITORIAL
BY DEBRA SHARP

Engines, engines, engines

The .40 2-stroke is the backbone powerplant of our hobby, and it's used in everything from trainers to sport-scale warbirds. Because of the competitive market and the choices offered by many companies, the sport .40 is probably the most cost-efficient engine available. Moreover, because these engines are often the power source of choice for newcomers and novice pilots, we thought it appropriate to do a comprehensive shootout on the most inexpensive .40s available—and who better to do this than *Model Airplane News* columnist and book author, "Dyno" Dave Gierke? Not only did Dave break in, dyno-test and take rpm readings on each engine with a comprehensive array of propellers, but he also tore each one down for an up-close look at the internal components. Want to know the truth about rpm, horsepower and torque? Check out Dave's findings on page 42 and see how much power $100—or less!—will buy.

NEAT FAIR

A few years ago, most modelers saw electric power only as a way to get high aspect ratio gliders aloft, but now electric power has found its way into all venues: scale, pattern, pylon—you name it. The Northeast Electric Aircraft Technology (NEAT) Fair is one of many successful fly-ins around the country that focus on electric-powered RC aircraft. On page 30, John Worth reports on this inaugural event in the rolling hills of southeastern New York. If you're intrigued by the awesome potential of electric-powered RC flight, this is one event you won't want to miss next time.

DESIGN CONTEST

One the best parts of this job is sifting through all the entries in our design contests and seeing the amazing creativity of our readers. One of the most difficult parts is picking the winners because there's so much talent out there, but this year, you helped us by emailing and sending in your votes. We thank everyone who participated—especially those who sent in photos of their pride and joy. We look forward to publishing feature construction articles and plans of the winning designs in future issues.

David Elias converted this 3 Sea Bees ARF to a Bristol F2B biplane and flew it at the NEAT Fair.

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FOUNDED 1929

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Senior Technical Editor GERRY YARRISH
Senior Editor CHRIS CHIANELLI
Assistant Editor MATT BOYD
Editorial Coordinator DANA DONIA

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Bob Aberle, Dave Baron, Rick Bell, Joe Beshar, Bernard Cawley, Roy L. Clough Jr., Roy Day, Don Edberg, Dave Garwood, Dave Gierke, Henry Haffke, Greg Hahn, Tom Hunt, Michael Lachowski, Andy Lennon, George Leu, Mike McConville, Jerry Nelson, Jim Newman, Vic Olivett, Jim Onorato, Dave Patrick, Dave Platt, Randy Randolph, Jef Raskin, Carl Risteen, Jim Sandquist, Jim Simpson, Faye Stilley, John Tanzer, Craig Trachten, Rich Uravitch, Dan Wolanski, Nick Ziroli.

AirAGE
100 East Ridge,
Ridgefield, CT 06877-4606 USA
(203) 431-9000 • fax (203) 431-3000
Email man@airage.com
Internet www.modelairplanenews.com

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AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

SMOKIN' THE GT-80

I recently purchased a new Zenoah GT-80 engine—what a beauty! I have a technical question that I hope you can help me with. I want to run a B&B smoke-pump

system with my '80. As you may know, this system requires tapping the crankcase for pressure to run the smoke pump. Where is the best place to drill and tap the crankcase for that purpose?

I also have a Zenoah G-62 running the same setup. Following one of your *Model Airplane News* "how-to" articles, I tapped the crankcase flange that forms the cylinder base. I had to grind away a little of the cylinder's bottom lip so it wouldn't block the pressure hole when the cylinder was re-attached. This procedure is pretty simple, and as long as you're careful not to get any metal chips in the engine, no harm is done. The system really puts out the smoke, too! So, would the twin cylinder be tapped in the same place—the crankcase flange that forms the cylinder base (on only one of the cylinders, of course)? Thanks for the assist; keep the great issues coming!

BARRY J. HALL
Britton, MI

Barry, I have a GT-80, too, and I agree: it is a sweet-running 4.8ci twin. For the single-cylinder Zenoah engines, the February 1993 Model Airplane News *article, "How to Make Smoke with your G-62" by Rich Uravitch is a very good reference for installing the B&B Specialties smoke-pump system. But for the GT-80, the procedure is much easier! As you know, the single carburetor that feeds both cylinders is mounted on an intake manifold at the top of the engine. With this arrangement, the carb is isolated from the crankcase. To make the diaphragm pump in the carb function, the carb is connected to a black rubber air line leading to the crankcase; this line feeds crankcase-pulse pressure to the carb's diaphragm to make it work properly. So, to supply pulse pressure to your smoke pump, all you have to do is cut the line between the carb and the crankcase and install a T-fitting. Connect the fitting to the smoke pump with another air line, and you're done—pretty simple. Good luck with your smokin' GT-80.*
GY

TACHOMETER TEST

I have been a regular reader of *Model Airplane News* since the early 1960s. During this time, I've had the pleasure of following Nick Ziroli's many and varied original designs and, in more recent years, being overwhelmed by his mammoth scale creations. My comment here is only intended to clarify a point.

In his review of the Kyosho Learjet in the January 2001 issue, Nick said he wanted to take tachometer readings of the rpm of the fans, so he painted half the spinners white. He indicated that they only showed 11,000 and 11,200, which he felt was rather slow for ducted fans. I suspect that

they were actually turning at 22,000rpm—about normal for a similar setup in my Kyosho T33.

By painting half the spinner, the optical tach is only "seeing" one pulse of light for each revolution, whereas a tachometer is usually configured to "see" two pulses from a 2-blade propeller.

I placed two strips of white adhesive tape on the side of the spinner, 180 degrees apart. A good light source is necessary, and the tachometer should be positioned off to one side of the spinner so that it sees the light reflected off the tape strips only one at a time. (If a light is necessary, use a flashlight, not a lamp plugged into the household electrical supply; this could cause erroneous tach readings.)

I believe that a check of rpm and/or current against some predetermined data is a good way to ensure that any electric model will perform as advertised. All the best.

P.S. It was great to see Nick's plan and article for the little electric Aeronca Champ in the November 2000 issue of *Model Airplane News*. [email]

IAN CARTER

Ian, thanks for writing. Nick also caught this error after he had written the review, but the issue was already on the presses. By the way, Nick is now working on a twin Speed 280 Wright Flyer. We'll keep you posted!

DS

JO KOTULA CONTEST WINNERS

This painting of an F4F-4 Wildcat first appeared on the cover of our August 1955 issue and looked just as spectacular then as it did on the cover of our January 2001 issue. We thank everyone who entered the contest and enjoyed the reminiscences of that time that so many of you shared with us.

The following five winners were chosen from the first 50 correct entries we received. Each will receive a free, one-year subscription to *Model Airplane News*. Congratulations!

Robert Macy, Cherryville, KS

Reg Batterson, Powhatan, VA

Gene Haynes, Groveland, CA

Bill Westerdahl, Sioux Falls, SD

Jim Polles, Nazareth, PA

New products or people behind the scenes: my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

2 new Zaps

Pacer, maker of high-quality Zap glues, offers two new, special-use, CA adhesives: Sheet Zap and Flex-Zap II. Newly formulated, clear-drying Flex-Zap II is solvent- and moisture-resistant and can withstand tremendous shock and vibration. It's ideal for use with fiberglass and carbon fiber.

Because it affords the builder plenty of working time and won't run due to its extra thickness, Sheet-Zap is perfect for sheeting procedures, even if 45-inch wing panels are to be sheeted (not for use on foam).

Frank Tiano Enterprises (FTE), 15300 Estancia Ln., W. Palm Beach, FL 33414; (561) 795-6600.

Simplify your RC life

A few years back, the UPS man delivered a computer radio to my front door. I opened the box, took one look at the phone-book-size instructions and screamed, "I want to fly—not read 'War and Peace'!" If you're like me, and you like to keep your electronics simple, check out Futaba's new 6DA with Flight Set Control Center panel. Yes, computer radios are getting easier to use all the time, and it doesn't get any easier than this. All of the following functions can be adjusted with the provided screwdriver: ATV (adjustable throw volume), EPA (endpoint adjustment), dual rates, aileron differential, flap-elevator mix and aileron-rudder mix, and all of this can be done without hearing any annoying beeps. Oh, yes; the electronic trims have center detents so you can find trim centers without having to look at the transmitter—not a good thing to do if you happen to be flyin'! This is my kind of radio.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

33-percent Extra

"Built-in-the-bones"

This is RadioCraft Industries' ARC (almost ready to cover) Extra 330LX. The inset photo represents its out-of-the-box state of completion. Construction is entirely of balsa, lite-ply and foam ribs. Features include plug-in wings; epoxy/glass cowl and wheel pants; aluminum wing and stabilizer tubes; pretrimmed canopy and very detailed instructions. The design meets all IMAC, IMAA and QSAA competition rules. Specs: wingspan—104 inches; wing area—1,950 square inches; length—96 inches; weight—23 to 25 pounds; engine requirements—70 to 105cc (4.2 to 6.2ci) ignition.

RadioCraft Industries Inc., 1843 E. Leland Cir., Mesa, AZ 85203; (480) 251-1094; trailblz@aol.com.

M1 Gas Pump

Slimline has had such success with its M1 glow-fuel pump that it has decided to add this gasoline version to the line. This all-in-one, ready-to-use pump features a rigidly mounted crank pump (the same design as on the glow version, and which works really well); red-anodized, CNC-machined, O-ring-sealed cap that keeps gas fresh and safely sealed; a UL-approved container and high-quality Tyron gas tubing and hardware. This is a complete fueling system that leaves you with nothing else to buy.

Slimline Mfg., P.O. Box 3295, Scottsdale, AZ 85271; (480) 946-9800; fax (480) 946-9802.

Hitec's Digital Lineup

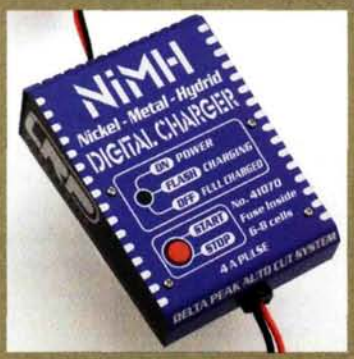
Hitec's servos have entered the digital age: the new 625MG, 645MG, coreless 925MG, 945MG and HS-5735MG all feature digital amplifier technology and come with unbreakable gear trains and aluminum servo arms. The incredible resolution, centering and holding power of digital servos can't be beat. Word is that Hitec will soon offer a hand-held servo programmer, so you'll be able to program features such as center, fail-safe and endpoint into each unit. We'll keep you posted!

Hitec RCD Inc., 12115 Paine St., Poway, CA 92064; (858) 748-6948; fax (858) 748-1767; www.hitecrcd.com.

LRP for aircraft

—a new name with experience

LRP's name is highly respected in the RC car-racing arena. Top drivers from both American



and European race teams use LRP products on the competitive race circuit and do very well with them. LRP has now decided to apply its ultra-high-tech expertise to the electric airplane market. It will introduce chargers and speed controls for both Ni-Cd and nickel-metal-hydride batteries. LRP's product line is manufactured in Germany and is of very high quality. Watch for these products.

LRP Electronic; distributed by Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626-1403; (714) 850-9342; fax (714) 850-1744; also available from LRP Electronic, Wilhelm-Enssle-Strasse 132-134, 73630 Remshalden, Germany; 1149-7181-4098-0; www.lrp-electronic.de.

Mighty Mini & Micro

When JR first introduced its 155 oz.-in. DS8411 Ultra-Torque Digital servo, it truly represented a breakthrough in power and accuracy in a standard-size servo. Now, JR offers the same technology and unprecedented holding power in both a mini- and micro-size servo. The DS3421 Ultra Torque Mini delivers 65 oz.-in. of torque with a transit time of .18 second at 4.8 volts. The DS368 Ultra Torque Micro delivers 53 oz.-in. of torque with a transit time of .21 second at 4.8 volts. Considering the diminutive size of these servos, these figures are quite impressive. Both servos feature multi-alloy gear trains.

Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511; www.horizonhobby.com.

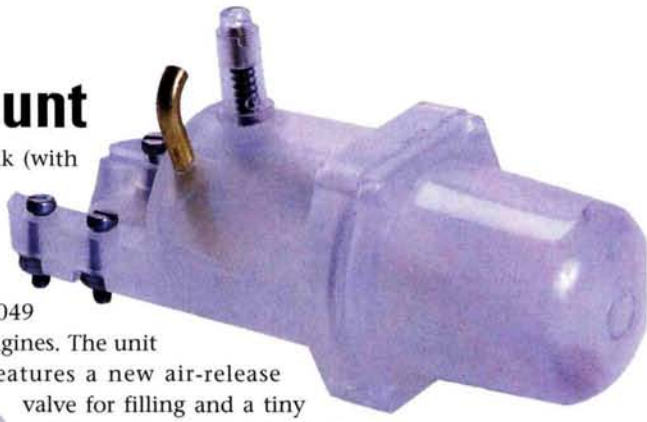
TRU-TURN WHEELS ARE HERE!

With a name like Tru-Turn, wheels should be part of their product line. Highly respected for its line of precision spinners, Tru-Turn now offers wheels ranging from 1½ to 4 inches in diameter, in two- and three-piece sets (depending on application). The set pictured here is for Lanier RC's Dominator 1500 Unlimited Racer. If Tru-Turn wheels can satisfy the demands of the unlimited racing scene, you know they must be good.

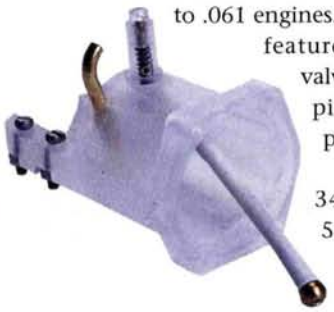
Romco Mfg., P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630.

NORVEL

Tank/Mount



This extended fuel tank (with slightly less than a 1-ounce capacity) and motor mount have been predrilled for standard .049 to .061 engines. The unit features a new air-release valve for filling and a tiny pick-up clunk. Here's the best part: it sells for only $9.99.



Norvel, P.O. Box 3459, San Luis Obispo, CA 93403-3459; (800) 665-9575; (805) 547-8360; fax (805) 547-8365; www.norvel.com.

SATURN'S CERAMIC SLEEVE

There has been a lot of talk about plasma-coated (ceramic) sleeve technology and the benefits derived from such a process. Rumor has it that the resulting sleeve surface is nearly indestructible. There have been a lot of positive rumblings in the industry about ceramic sleeve use in glow engines, but we at *Model Airplane News* can neither confirm nor deny them because we have not yet tested a unit—although we hope to do so soon. The aluminum piston and ceramic-coated sleeve kit pictured here happen to be for an O.S. .46FX.

Saturn Hobbies *of Florida*, 271 Narragansett St. N.E., Palm Bay, FL 32907; (321) 728-9757.

Wattage Thermalaire EP

"No glue needed!"

With the Wattage Thermalaire EP, you'll get into the air quickly—very quickly! This is an all-wood airframe that comes factory-built and covered. The included 540 motor and 8x4 folding propeller are installed, and the tail section has been bolted onto the fuselage for easy assembly. Outer wing panels are simply pinned into the wing center section. This plane breaks down quickly and will fit into any small car. Thermalaire will fly on 6-, 7-, or 8-cell packs and standard radio equipment. Specs: wingspan—72 inches; wing area—505 square inches; length—34.5 inches; weight—44 ounces; wing loading—12.6 ounces per square foot.

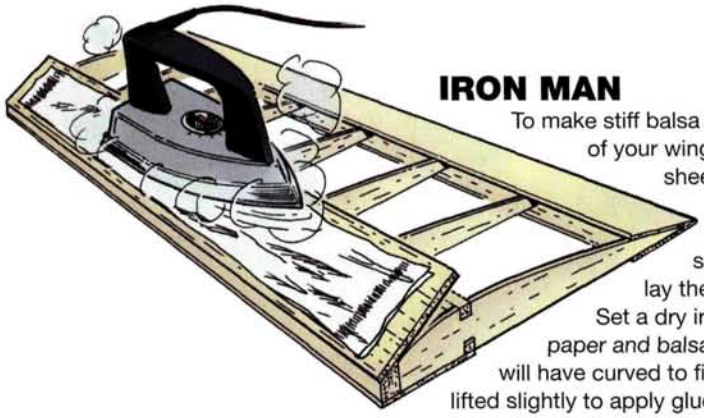
Also shown is the Wattage Hawk, which is small (30-inch wingspan) yet rugged and flies slowly; great for tight areas. Features include a high-strength molded fuselage; closed-cell, foam-sheeted wings with molded EPS foam internal support; quick and simple assembly (only one glue joint), and a detailed instruction manual. Motor/prop/power system included. Specs: wingspan—30.125 inches; wing area—154 square inches; flying weight—11 to 12 ounces; wing loading—10.25 to 11.25 ounces per square foot.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

HINTS & KINKS

BY JIM NEWMAN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



IRON MAN

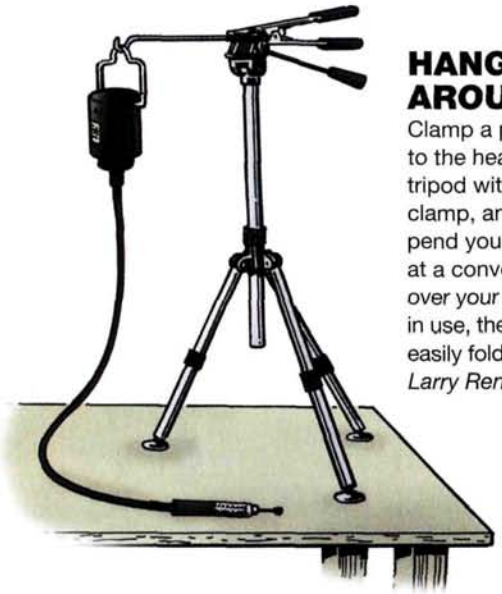
To make stiff balsa sheeting conform to the curve of your wing's leading edge, first glue the sheeting to the beveled leading-edge spar. Wet two layers of paper towels with water, squeegee off the excess, then lay the wet paper on the sheeting. Set a dry iron to "high," then iron the wet paper and balsa sheet until it is dry. The sheet will have curved to fit the ribs perfectly and can be lifted slightly to apply glue to the ribs.

Bruce Burns, Barnum Lake, Ontario, Canada

SECURE PLUGS

Prevent battery-pack plugs and servo-extension leads from pulling apart by shrinking a sleeve over them.

Joe Kazakavage, Sebastian, FL



HANGING AROUND

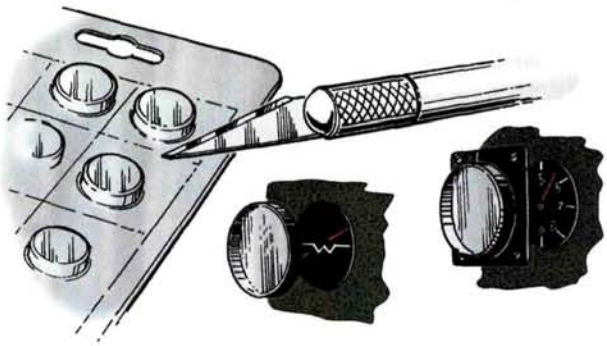
Clamp a pegboard hook to the head of your photo tripod with a welder's clamp, and use it to suspend your motorized tool at a convenient height over your bench. When not in use, the tripod can be easily folded and stored.

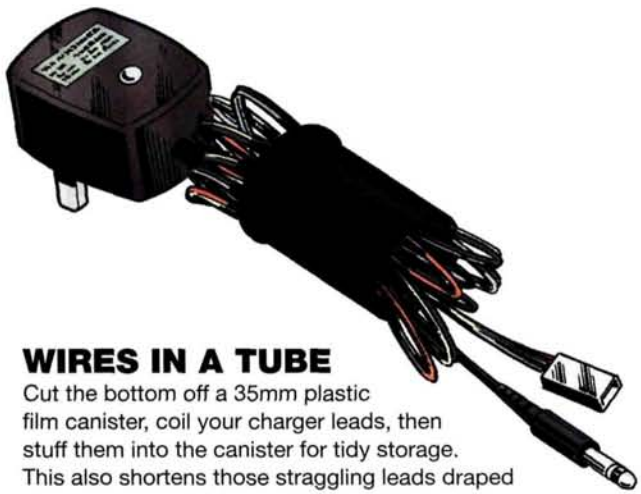
Larry Renger, Cerritos, CA

INSTRUMENT MAKER

Slice the transparent blisters from hearing-aid battery and pill packages to create instrument panel covers. Two types are shown; one is the typical military kind with the mounting flange. Brads with a blob of thick CA on the head form neat adjusting knobs for gyros and altimeters.

Dave Schwarzen, Festus, MO





WIRES IN A TUBE

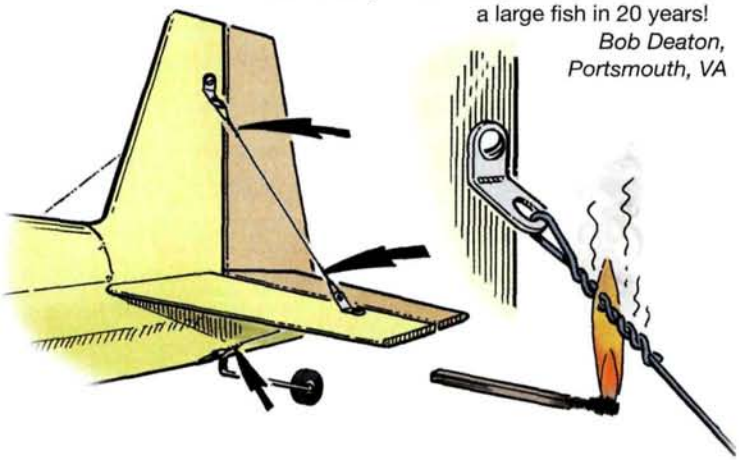
Cut the bottom off a 35mm plastic film canister, coil your charger leads, then stuff them into the canister for tidy storage. This also shortens those straggling leads draped across your model, too.

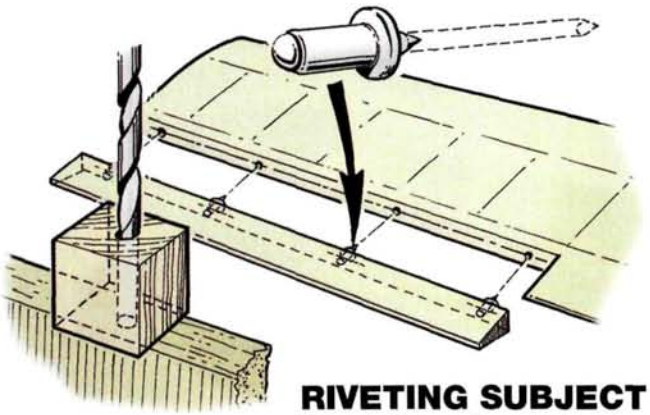
Bill Braatz, Merrillville, IN

BRACING UP

Heavyweight nylon-coated fishing trace is convenient and a good material to use to brace your model's tail group. Form the attaching loop through the metal bracket, twist it around itself to form a neat coil, then carefully heat with a soft flame to fuse the nylon coating (shield the tail surfaces from the heat source with wet cardboard). Add shrink sleeve or twist a piece of wire insulation over the coil to make it look neater. Our contributor assures us of the security of this arrangement; he hasn't lost a large fish in 20 years!

Bob Deaton, Portsmouth, VA

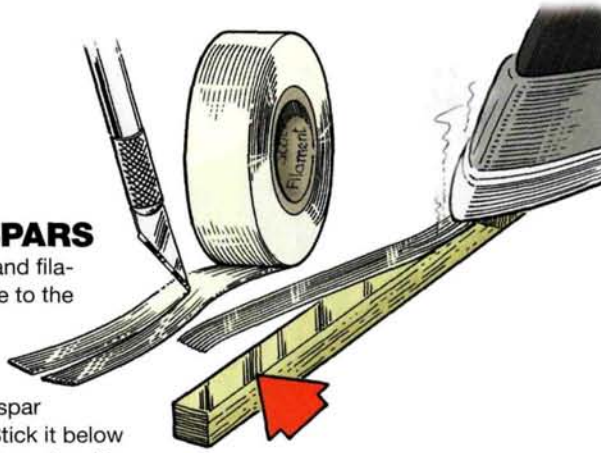




RIVETING SUBJECT

Cut and sharpen the mandrel of POP-brand rivets to make a set of dowel points. Drill the aileron for hinge points, then press in the dowel points. Mark a centerline on the wing trailing edge, then firmly press the aileron against the wing to create dimples in which to place the drill. Dave uses a hardwood block with a close-fitting hole as a drill guide when drilling holes for hinge points.

David Smith, Mission Viejo, CA



TOUGH SPARS

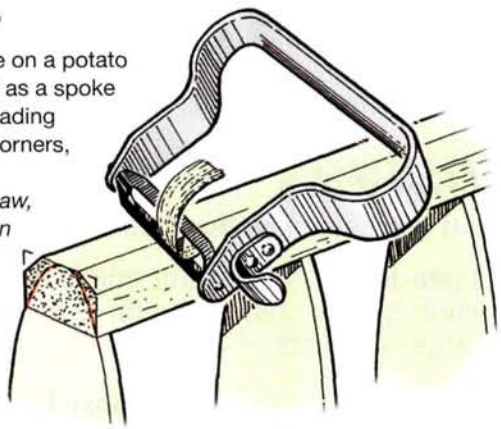
Split Scotch-brand filament parcel tape to the width of your spars, then bond it to the surface of your spar with Balsarite. Stick it below molded foam wings, too. Don says he has never had a wing failure on tow. You can also use aliphatic resin wood glue. Apply a thin coat, allow it to dry, then iron the tape firmly to it to bond it into position. 3M says the filaments are glass, and glass has a tensile strength approaching that of steel.

Don Baker, Aiken, SC

PEEL OUT

Hone a keen edge on a potato peeler, then use it as a spoke shaver to carve leading edges, fuselage corners, cowls, etc.

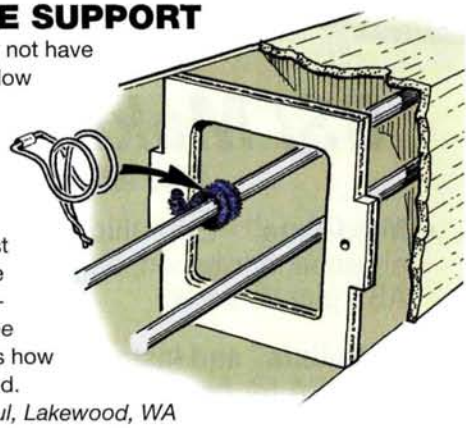
Avey Shaw, Huntington Station, NY

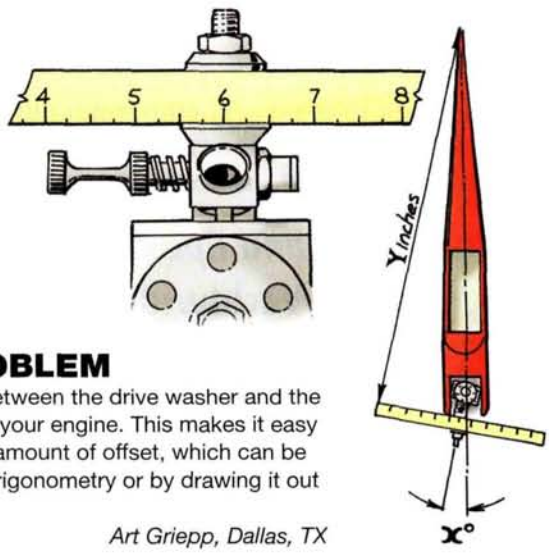


FUZZY PIPE SUPPORT

Narrow formers do not have enough width to allow drilling for Nyrod support, so drill a small hole, push a pipe cleaner through it, then wrap and twist it tightly around the Nyrod before soaking it in thin CA. The coil diagram shows how to wrap the pushrod.

Brad Faul, Lakewood, WA





TRIG PROBLEM

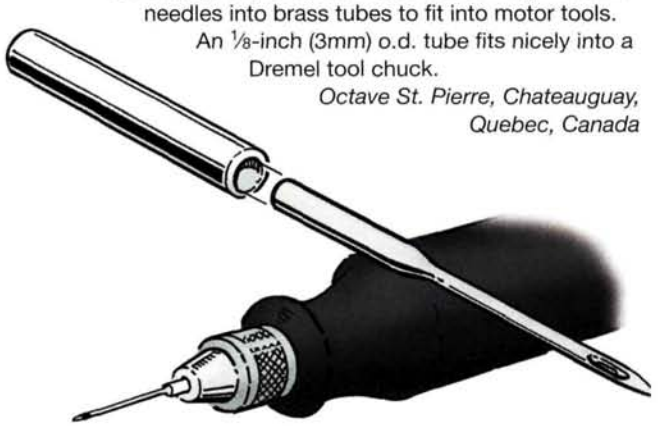
Clamp a ruler between the drive washer and the prop washer on your engine. This makes it easy to measure the amount of offset, which can be determined by trigonometry or by drawing it out on your plan.

Art Griepp, Dallas, TX

NEEDLE DRILL

For drilling very small holes, solder sewing-machine needles into brass tubes to fit into motor tools. An ⅛-inch (3mm) o.d. tube fits nicely into a Dremel tool chuck.

Octave St. Pierre, Chateauguay, Quebec, Canada



PILOT PROJECTS

A look at what our readers are doing

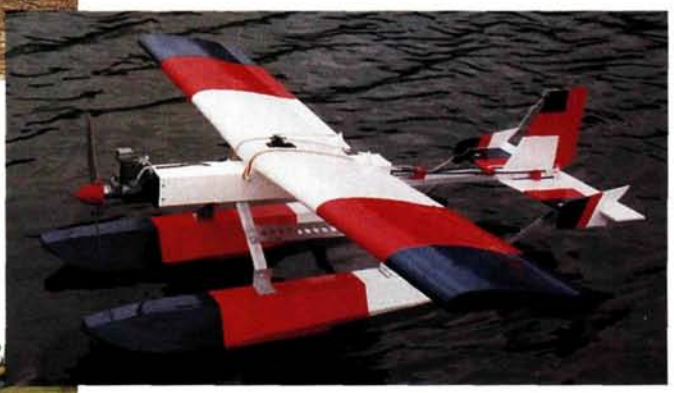
SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

TWO TURNING TAIL

Pals Richard Fish (right) and David "Leo" Lichodziejewski (left) of Fountain Valley, CA, knew that they'd never be able to determine who was the better pilot unless they made the same modifications to their planes. They started with a pair of Jamara Sunriser ARFs, added inverted V-tails and ailerons and relocated the wing mounting points. They report that these electrics are both very efficient and glide beautifully on the lightest thermals. Their competitions are a true test of pilot skill; the last one down wins!



LEARNING FROM EXPERIENCE

Garrett Milne of Tupelo, MS, sent in this photo of his father-in-law David Leatherman's Duraplane .40 floatplane. David got the idea to mount floats after he "landed" one in a lake without floats! The plane has a Magnum XL-52 4-stroke and Futaba radio gear, and David and Garrett mounted Great Planes' .40-size floats to make sure any future water landings would be less dramatic. While they were at it, they added wing and elevator extensions and mounted cool, '57 Chevy-like fins on the horizontal stab.

SWISS STALLION

Danny Baumann has to contend with strict noise regulations in Winterthur, Switzerland, so using the U.S. 41 engine for his Top Flite 1/5-scale P-51D was impossible. Instead, he opted for a German BFM45 gasoline engine with an internal muffler and exhaust system that exits where the rear oil cooler was on the full-size plane. It turns an APC prop at 5,700rpm, and Danny reports that it sounds like the real thing. The finish is epoxy cloth and automotive lacquer in the colors of WW II's second-highest-scoring Mustang ace Lt. Col. John C. Meyer's personal Mustang, "Petie 3rd."

SPIRITED CONVERSION

Kenneth Morse of Traverse City, MI, thought this '40s era, free-flight model would make a good RC project, so he decided to convert it. Basing it on a Henry Struck design called the New Ruler, Kenneth drew his own plan using a small 3-view of the original and scratch-built his plane. The finished model weighs just under 6 pounds, and Kenneth appropriately named it Free Spirit. A K&B Green Head engine provides power, and he controls the plane with a World Engine single-stick radio.

KOREAN COMBATANTS

These two vintage jet fighters were scratch-built by Mark Schuler of Columbia, IL, from Gus Morfis' 704 combat plan. Mark modified the plan to produce a more scale look for the F-86 Sabre and MiG-15, both of which are finished in MonoKote and vinyl graphics. The MiG has an O.S. .32; the Sabre has a Mecoa .32, and Mark says that both planes are very fast. Just imagine the exciting dogfight maneuvers when both of these little warbirds are in the air!

SINGAPORE KNOCK-OFF

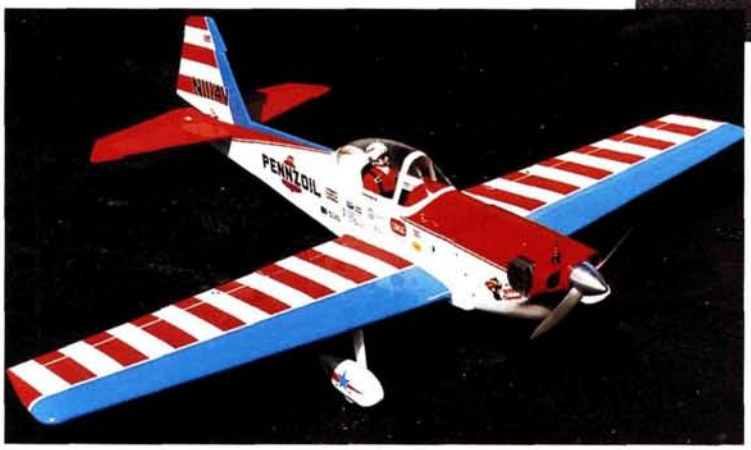
Bernhard Schaufelberger regularly fools his fellow club members in Singapore with his Sky Loop kit painted to look like a PT-19. The plane features a nosewheel, and Bernhard reports that it's an excellent low-wing trainer that can also perform intermediate aerobatics. The wingspan is 58 inches on this PT-look-alike, and it's powered by an O.S. .46 LA engine. Futaba radio gear provides control for this fun little impostor. ▼

BEARCOUPE ▲

Avey Shaw of Huntington Station, NY, proudly displays his dedication to the hobby on his scratch-built Ercoupe. Based on a Ziroli plan, this model has the number 46 on the rudders, signifying that it's the 46th RC plane Avey has built. A Zenoah 23 gets his model airborne, and he relies on Robart wheels and struts when it returns to earth. The fuse is glassed, and the wings are covered in Sig Coverall. Avey painted this 13-pound beauty with latex and top-coated it with water-based urethane. Yogi Bear was selected to pilot the model because—of course—he's smarter than the average bear!

WORTH WAITING FOR

Percy McAfee of Hampton Bays, NY, tells us that the *Model Airplane News* Jet Special back in 1989 inspired him to get started in the hobby. The very first kit he bought was this Carl Goldberg Models' Super Chipmunk, but he knew he wasn't up to the challenge then, so he set it aside to hone his skills on other projects. Now it looks and flies great with a SuperTigre 61 and Futaba radio gear. Percy covered his Chipmunk in Ultracote and used Chevron paint on the cowl, wheelpants and canopy. ▼



HISTORICAL HEINKEL ▲

Dick Eimert of Monsey, NY, scratch-built this Heinkel He 51B from a plan designed by Alan Blount and obtained from Aviation Modeler Plans Service. Dick dressed his biplane with the colors and markings of a 1942 German fighter training squadron, the A/B Schule 71 at Prossnitz. An O.S. FS 70S 4-stroke powers this 7.6-pound, 68-inch-wingspan model. The cowls and wheelpants were made from fiberglass cloth and resin in a plaster mold cast, and the plane is covered in MonoKote.

A beautiful flight shot of David Elias' Blériot monoplane. David converted the 3 Sea Bees Models ARF several years ago, and it has been a very good performer.*

One of several new models brought to the NEAT Fair by Hobby Lobby, the Terry is an all-foam-powered glider/sport model with excellent performance.

Winners

The NEAT Fair gang awarded prizes to several modelers for special recognition and achievement in electric modeling. The lucky recipients were:

BEST IN SHOW (donated by the National Electric Aircraft Council [NEAC])
Jim Ryan . . . . . .Speed 400 Warbirds

BEST SPORT MODEL
Laddie Mikulasko . . . . . Canadian Bug

BEST SCALE MODEL
Steve Stratt . . . . . .Junkers D-1

TECHNICAL ACHIEVEMENT
Dave Dantonio . . . . . .Acro 260E

This Speed 400-powered Canadian Bug earned Laddie Mikulasko the Best Sport Model award.

Best in Show winner Jim Ryan shows off his newest design: a Speed 400-powered P-47 Thunderbolt. Jim received the award for his squadron of Speed 400-powered WW II warbirds, including an F8F Bearcat, a P-38 Lightning and an F4U Corsair; all for 6V Speed 400 motors.

Northeast Electric Aircraft Technology Fair

A new showcase for E-Flyers

by John Worth

Just a few of the many models that Laddie Mikulasko brought to show off. Left to right: a French Potez-Cam 161 powered by six Speed 400s, a Russian Tupolev ANT-20 with eight geared Speed 400s and a French Dewoitine D-338 powered by three geared Speed 400 motors—a very impressive collection!

When the KRC electric meet was discontinued two years ago, the disappointment was heard around the electric world. This well-established annual gathering of RC electric-power enthusiasts was always a showcase of the latest and best of what was happening in this field. In fact, the rapid growth in state-of-the-art electric power was largely—and properly—attributed to what was shown and flown at KRC events.

But as a result of tireless efforts by Tom Hunt, Bob Aberle and other members of the Silent Electric Flyers of Long Island (SEFLI) and the Grumman Wingnutz R/C Squadron, the spirit and substance of past KRC meets was reborn this year. They put their heads together and worked for over a year to come up with a replacement event of equivalent or better value to pick up where KRC left off. Joe Beshar played a key role in making the Northeast Electric Aircraft Technology (NEAT) Fair possible. He knew the site and the people in charge of it, and he was the liaison who brought everyone together. Without Joe, the gap between the end of KRC and the beginning of NEAT might have been a lot longer. With Joe's help, the SEFLI group pitched in to make NEAT happen.

Far left: Steve Stratt won Best in Scale with his WW I Junkers D-1 monoplane. Left: Dave Dantonio prepares his Acro 260E for another demo flight. Dave won the Technical Achievement award for his twin AstroFlight 60 with homemade belt-drive power system that powered his 8-foot-span model.*

Another 3 Sea Bees ARF converted by David Elias; this one is a Bristol F2B biplane with a 95-inch span. Weighing 26 pounds, the 1/5-scale model has an AstroFlight 60 motor with a 2.7:1 gearbox to turn the 23x12 prop.

This all-foam Slow Flyer Simprop Pfalz DIII biplane is from Hobby Lobby. Powered by a geared Speed 280 and seven 500mAh cells, the little WW I fighter flies very well.

Slow Flyers at NEAT

One very obvious facet of the NEAT Fair was the great number of slow- and park-flyer models on hand. It seemed that almost everyone had at least one Speed 280- (or smaller) powered model in their squadron of E-machines. Driven by the continuing developments in sub-miniature electronics, battery technology and power systems, slow-flyer models such as the ever present "foamies," delicate stick-and-tissue covered ARF floaters and even some carbon-fiber and Kevlar-built aerobats are enjoying a tremendous growth phase. Companies such as Hobby Lobby, Northeast Sailplane and several talented designer/builders are offering a bumper crop of lightly loaded, gear-driven planes. If you've ever wanted to turn your backyard into a flying field or dreamed of using the local high-school gym as active air space, then now is the time for your first slow-flyer fling. Give it a try, but be warned: you can't fly just one!

This fun-looking Rogallo-winged Explorer has two channels and flies for more than 12 minutes on a NIMH pack. Don Jehlik of Funcraft Planes showed us this one.*

The new event was an unqualified success. Held in late September 2000 at a marvelous place called Peaceful Valley in the southeast corner of New York State, the workers produced the first of what we hope will be many annual NEAT Fairs. The site is a campground in a valley with beautiful scenery all around, so the atmosphere is idyllic—truly peaceful and a perfect background for the quiet, graceful and often majestic electric-powered model flying that prevailed.

The weather was excellent on the first day: sunny, cool and calm, so there was a lot of flying, typically with six or more planes of all sizes, shapes, colors and speeds sailing through the air at the same time. Even on Saturday, when the sun stayed away and activity slowed down a bit, the flying went on. Particularly magnificent were the frequent flights of a large, four-motored WW II vintage B-17 bomber model flown by Dave Baron. This plane was built by Joe Beshar and had been flown at many KRC meets. It flew at realistic airspeed, lowering its retractable wheels for great touch-and-go's and graceful, smooth landings. It seems nothing is out of the question for electric power.

Jim Ryan's F4D Skyray sets off on another impressive flight. Powered by a Plettenberg HP-206-20 motor with 10, 800AR cells spinning a WeMoTec mini-fan, the "Ford" weighs 38 ounces. Don Belfort assists on the bungee launch.*

Sunday threatened to be a complete weather wipeout, with dark clouds overhead obscuring the mountaintops and the feeling that rain might come at any time. But the morning air was calm, and those who came out after breakfast took advantage of the quiet, foggy morning to get in as many flights as possible. Flying continued busily, as the lack of wind encouraged many to enjoy a few more hours of relatively good air rather than pack up and go home. Around 1 p.m., when many folks needed to leave for long drives home anyway, the weather became drizzly and windy. That effectively closed out the weekend, but not really on a sour note; it was a good time for most of the fliers to say good-bye.

All in all, the NEAT Fair was a happy affair, with the participants thankful to be a part of the reunion of friends and

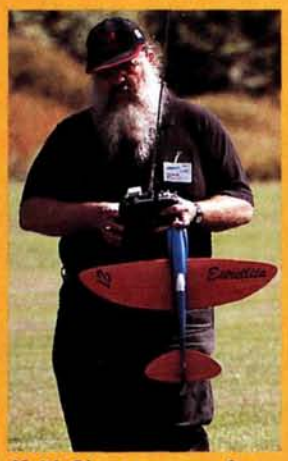
Look, Ma; no tail! Actually, this all-foam Hitec Sky Scooter flown by Hitec's own Glen Merritt flies just fine without one. Glen removed the stab and elevator, moved the elevator servo to the wing (next to the aileron servo) and extended the ailerons with sheet balsa. He then cranked in some "up" in both ailerons to reflex the wing and used a Hitec 3-channel radio with elevon mixing to fly the model.*

Lunch-hour Demo Show

Each day at the NEAT Fair, there was a noontime break in the general flying to allow everyone to view the impressive demonstration flights. Most of the flights during the show were performed by veteran airshow pilot Keith Shaw, who flew his impressive collection of scale models. Included in his squadron were his 81-inch Grumman F8F Bearcat, an elegant Fokker D-VIII and his tiny Estrellita. Keith also demonstrated a very large sport scale Acro 260 built by David "Turbo" Dantonio. Dave's airplane, powered by his home-made Twin Astro 60 belt-drive unit, had a 96-inch span and used 72 cells for power. Also part of Keith's collection of models—though not flown—were his unusual Art Chester "Goon" Golden Age racer and a beautiful twin-motor de Havilland Comet racer.

Jim Martin gathers up the parachute lines from his RC parachutist.

Dave Dantonio's Acro 260E glides in after an impressive aerobatic flight.



Keith Shaw prepares for another flight with the ultra small Estrellita that was powered by an Astro 010 brushless motor and seven, 350 AAC cells. The model weighs only 10.5 ounces.

Keith Shaw's Fokker D-VIII.

E-JETS

Also flown was a twin-turbine-powered Kyosho Learjet piloted by Nick Ziroli Sr. Nick put on quite a show with the little ARF jet that he reviewed in the January 2001 issue of *Model Airplane News*; it was powered by twin Le Mans AP29L motors turning 3-inch fans. And speaking of jets, a great E-jet demo was flown by Jim Ryan, Chris True and Scott Black. They flew Jim's F4D Skyray, Scott's F-86 and Chris's lively MiG 15.

Providing some of the show's fun was Jim Martin of Hobby Lobby, who flew the new twin-motor Wingo Porter that was equipped with an RC parachutist drop. The little 'chutist hung from between the Wingo Porter's landing gear and rode up to drop height with ease. After the two parted company, the little guy did an impressive free fall before popping his silk. In all, the entire package is pretty impressive.

Nick Ziroli Sr. stopped flying his Kyosho Learjet long enough for us to take this picture. The Learjet is an ARF and is molded from rigid foam; excellent performer.*

The three electric-jet demo pilots, left to right: Jim Ryan, Chris True and Scott Black.

To end the collection of demo flights and to show what an AMA electric "all-up, last-down" competition is like, Bob Aberle flew his "Playboy Sr." old-timer to represent Class A Old-timer. Tom Hunt flew his "Retro Rocket" for Class A Sailplane, while Ric Vaughn flew his own scratch-built Class B sailplane. David Elias flew a Mark Kummerow design in Class ½A (Speed 400) Sailplane. All these models started with a mass launch and flew against one another while using their own class's motor-run time; Class A Old-timer (60 seconds), Class A Sailplane (45 seconds), Class B Sailplane (30 seconds) and ½A Sailplane (90 seconds). Ric Vaughn won easily.

Mike Ramsey flew up a storm with his Kyosho F-16 electric jet fighter. The 100-percent-stock out-of-the-box Fighting Falcon has very good performance.

Even electric helicopters got into the act. Here, Thomas Hizny's Kyosho Concept EPS-2 heli breaks into a hover before landing. The 7-cell, piezo gyro-equipped model can fly for 6 minutes.

electric-power fliers alike. Practically everyone seemed to appreciate the setting and the spirit that prevailed. The site is big and beautiful, and the event was well run, with just enough friendly control and organization to keep order without bruising egos. The general feeling I got from many was that they're looking forward to the next NEAT Fair, and they appreciated all the hard work that the SEFLI gang had done to provide a fine alternative to the old KRC events.

If you missed out the first time, don't fret; there's always a next time. The 2001 event is already being planned, and it looks just as promising as the first. If you'd like to get more information on the NEAT Fair, check out the website at http://www.nyblimp.com/neat.htm, or write to NEAT Fair, P.O. Box 1446, Lake Grove, NY 11755. The next NEAT Fair will be Sept. 14, 15, 16, 2001. See you there!

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**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.*

IMAC Aerobatics

by Dan Wolanski

Flying the Loop

Inside and outside maneuvers

The loop is a complete circle (360 degrees) flown vertically. There are two kinds: the inside and the outside loop, both of which can be entered from upright or inverted. The former is the type most usually attempted, and it is accomplished by inputting up-elevator as the plane circles an imaginary center point. To do an outside loop, the pilot inputs down-elevator.

More RC pilots attempt the loop than any other maneuver, and they probably do so within a month of flying solo. Flying a truly round loop takes significant concentration and is not as easy as it may look; it takes an aerobatic airplane such an Edge, Extra, CAP, or Giles with a power-to-weight ratio of at least 1.5:1. During the maneuver, power management is crucial to present a graceful, elegant display.

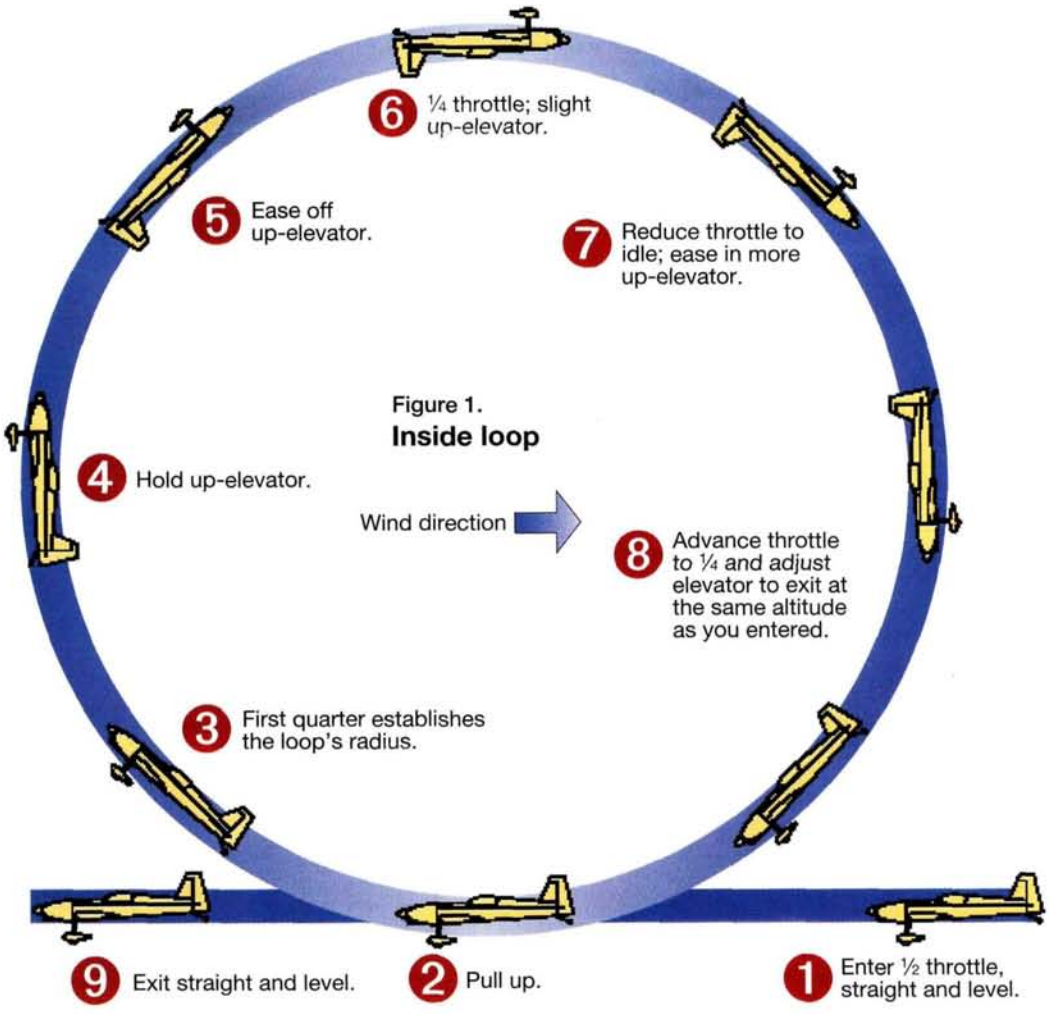


Figure 1.
Inside loop

THE INSIDE LOOP

The easiest way to practice an inside loop is to fly parallel to the runway and approximately 100 yards away. Enter the maneuver into the wind, straight and level and at ½ throttle. Just before you reach the loop's imaginary center, advance the throttle to full and then gradually apply up-elevator until you establish the radius you want. Having established this radius, you must stick with it for the entire maneuver.

Continue to hold the up-elevator you started with until you reach the vertical position (90 degrees into the circle). At this point, add a little more up-elevator because the plane has slowed down and the stabilizer has become less effective. Adjust elevator carefully to maintain a constant radius, and follow through until your model nears the top of the loop.

Near the top, let go of most of the up-elevator and reduce the throttle *almost* to idle (about ¼); how much you need of each depends greatly on the wind. Do *not* reduce the throttle all the way to idle, or you will "chop" off the back side of the circle. As you pass top center, start to gradually apply up-elevator and then cut the throttle to idle as you approach a vertical descent.

Depending on your plane's wing loading and your prop's

braking capability, it may or may not gain a lot of speed. It's therefore important that you adjust the elevator to bring the model out of the maneuver at the same altitude as it entered it. To do this, I avoid focusing directly on my plane and instead look at the big picture—the entire sky; it's kind of like being a spectator instead of the pilot. As pilots, we tend to focus too much on just the plane.

Finally, within 30 degrees of finishing, increase throttle to maintain a constant speed as your model exits the loop straight and level.

• **Correcting heading and roll.** Ninety percent of the roll and yaw corrections needed during a loop can be accomplished with the rudder; it will correct heading and minor roll problems. If you detect a roll problem while applying little or no elevator, correct it with your ailerons. Keep in mind that all inputs should be very gradual. Inputting elevator will increase drag and slow the aircraft, and this will change the effectiveness of the elevator, and you won't have a truly circular loop.

LOOP VARIATIONS

• **Outside loop.** This is considered to be an advanced maneuver, but it's technically the same as flying an inside loop; but pilots don't get as much practice "pushing" the elevator through maneuvers as they do pulling it, and this makes those who haven't practiced it uncomfortable. Outside loops require the same throttle management and corrections as inside loops, but there's the added com-

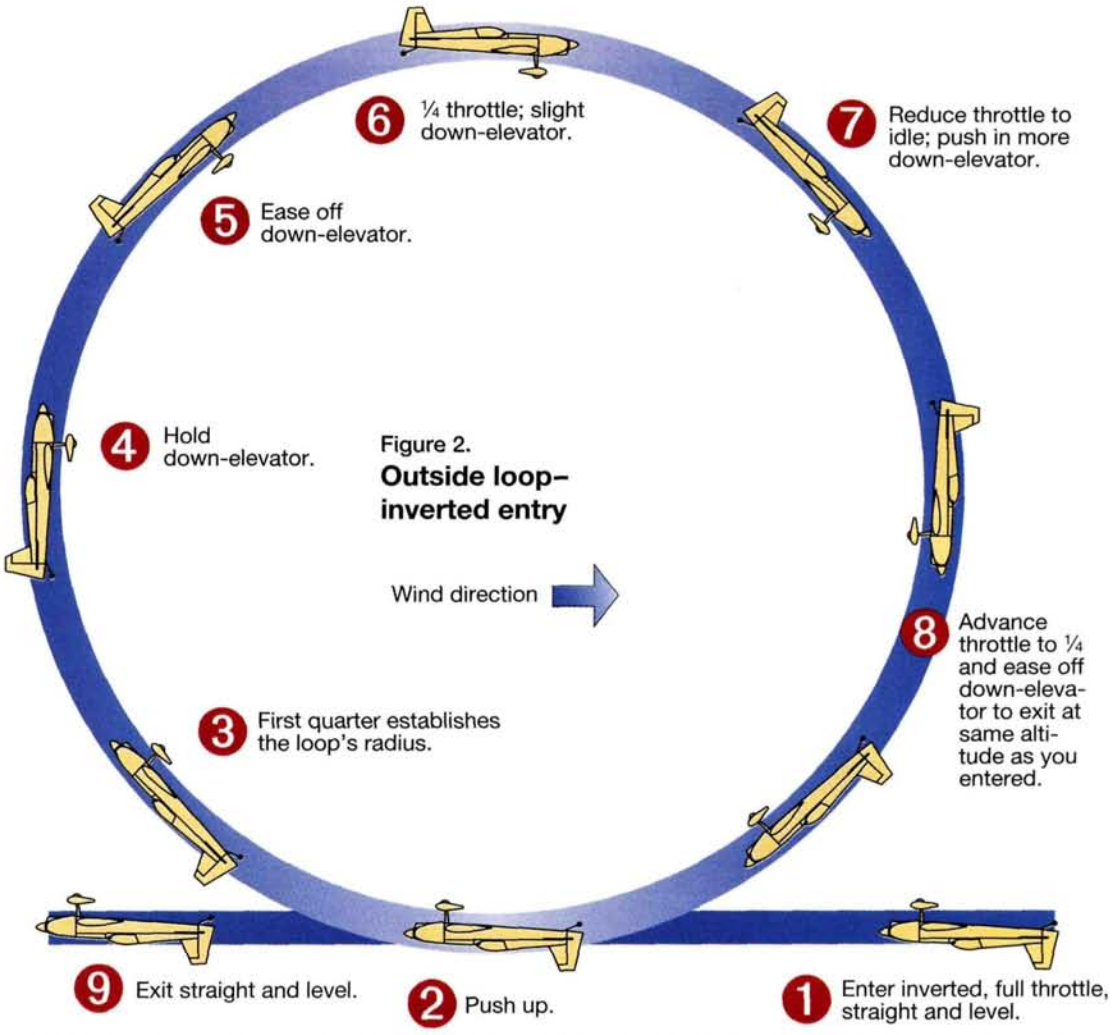


Figure 2.
Outside loop–inverted entry

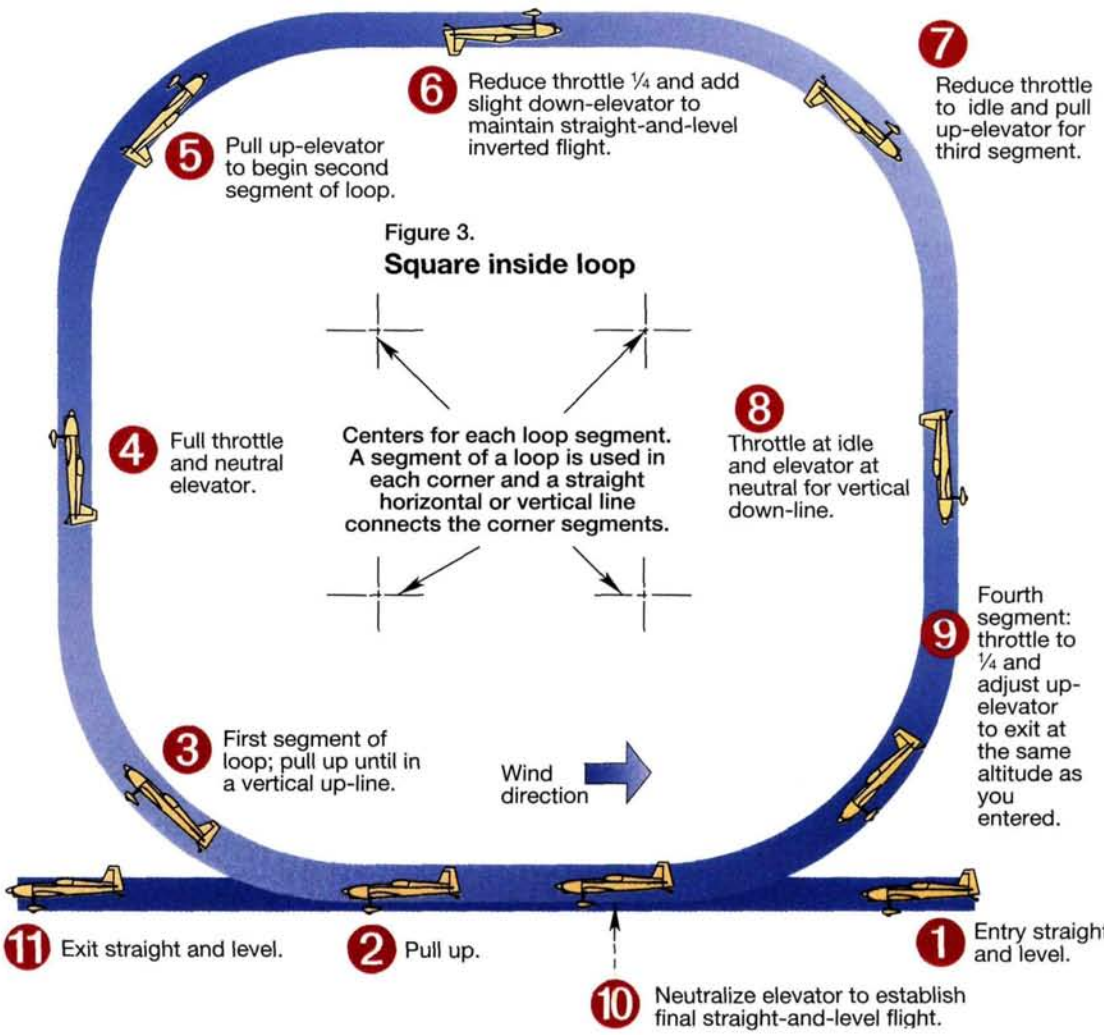


Figure 3.
Square inside loop

plexity of rudder and elevator being reversed when you fly inverted; the aileron adjustments, though, are the same as when the plane is upright.

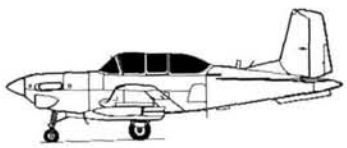
• **Segment loop**. One-quarter, half and three-quarter loops are the basic building blocks for nearly every advanced aerobatic maneuver. After all, most maneuvers are entered and/or exited while flying part of a loop. It's so necessary to your sequences that a loop segment should be what you practice most.

• **Avalanche**. This is a loop with a snap at the top and/or bottom. The maneuver requires not only mastery of the loop but also the ability to perform a snap roll from the inverted or upright position. Again, these are advanced maneuvers.

• **Rolling loop**. During this, the plane rolls continuously as it loops—not a precision-competition maneuver, but it looks beautiful when done right. You must apply rudder and elevator (toward the center of the circle) while holding aileron constant throughout the loop. This maneuver is very difficult to perform and is usually seen in freestyle sequences flown by topnotch IMAC Unlimited, Tournament of Champions and World Masters pilots.

• **Knife-edge loop**. Again, not a precision-competition maneuver, but it's a real kick to do while maintaining knife-edge flight and relying on rudder throughout. Pilots can easily complete the first upward segment of the knife-edge loop, but it takes a lot of courage and confidence to complete the second half as the plane hurtles toward the ground. I have found that the Ultimate Bipe is the best aircraft for this maneuver.

If you want to improve your aerobatics skills, mastering the loop will get you on your way to performing more graceful maneuvers in no time.



MODEL AIRPLANE NEWS
ENGINE
COMPARISON

9 powerplants under $100
Which is right for your model?

.40 ENGINE SHOOTOUT

O.S. Max .40 LA Silver—plain bearing

by Dave Gierke

We all want value for our money, but when it comes to evaluating our miniature RC engines, which criteria should we use to determine value? Cost? Performance? Warranty? Durability? Manufacturer and distributor reputation? Availability of parts? Service? Some of this information is relatively easy to obtain.

• **Cost.** Search for the best .40 prices; look at magazine ads, and check discount houses and hobby shops. But are you sure that you want the least expensive engine out there?

• **Performance.** Manufacturers don't always include horsepower data, and they never consider torque. Then there's the matter of truthfulness; engine reviewers such as yours truly can evaluate only 10 to 20 engines a year, and more than 600 are available worldwide!

• **Warranty.** Most manufacturers offer a limited replacement policy to cover defective parts and workmanship; a few offer full replacement for any reason, including crash damage!

• **Durability.** This is very subjective; circumstances play a large role, e.g., if you consistently set the needle valve too lean and use bargain-basement fuel with questionable contents, your engine will wear out quickly (or suddenly!). Likewise, if you buy an engine made of inferior materials or inadequately prepared components, you might need a new one before you're ready!

• **Manufacturer's reputation, availability of parts and service.** When the manufacturer or distributor is respected and has a history of acting honorably (word travels fast), you can expect fair prices for repair service and parts when you need them.

ARTICLE MISSION

The following analysis of nine popular low- to intermediate-price .40ci (cubic inch) engines is based on cost, performance, durability and warranty. All fall into the 2-stroke-cycle category; all have single cylinders and incorporate front-rotary-valve mixture induction with rotary-barrel throttle carburetors. All are designed with side exhausts and use simple, non-tuned expansion-chamber-type mufflers. Internally, they differ widely with respect to piston and cylinder design and materials. It should be no surprise that all engines use the Schnuerle system of cylinder porting (a standard for the industry). Crankshafts are supported either by bushings (plain bearings) or dual ball bearings; modelers often turn

Thunder Tiger GP-42—plain bearing

AT A GLANCE

■ **Enya SS .40—plain bearing ($68.08)**

Steel and iron piston/cylinder engine with sweptback needle-valve design for safety. Although it takes awhile longer than others to break in, it will have an extremely long and reliable service life because of its high-quality castings and materials.

Idle: good @ 2,500rpm, after extensive break-in with Enya G-type carburetor.

Mid-range: good, with a slight hesitation (rich) through mid-range transition.

Best props: 11x4, 9x6, 9x7.

■ **Enya SS .40BB—ball bearing ($95.98)**

The most expensive .40 tested here, this steel and iron lapped piston/cylinder engine features extremely high-quality craftsmanship and materials. It starts easily and provides good torque. Its relatively longer break-in time also equates to longer service life.

Idle: very good @ 2,500rpm, using a twin-needle fuel-metering carburetor.

Mid-range: excellent with thorough break-in; engine exhibits flawless transition through mid-range, with an average bore-size carburetor.

Best props: 11x5, 10x6, 9x7.

■ **Magnum XL .40 A2 ($70)**

This ABC engine is equipped with ball bearings and a remote needle valve for safety. It has a short break-in time and is especially suited to high-shaft-speed applications.

Idle: fair @ 2,700rpm with a fuel-metering, average bore-size carburetor.

Mid-range: very good transition, with no hesitation through mid-range.

Best props: 10x6, 9x7, 9x6.

■ **MDS .38 FS Pro ($74.95)**

This ABC, ball-bearing-equipped engine is especially suitable for high-speed applications using a low-drag airframe and relatively small propellers.

Idle: good @ 2,500rpm, for advanced crankshaft and cylinder timing.

Mid-range: fair; experienced hesitation (rich) at mid-range with a relatively large bore, twin-needle fuel-metering carburetor.

Best props: 10x5.5, 9x7, 9x6.

■ **O.S. Max .40 LA Silver—plain bearing ($56.99)**

This ABN engine has a remote needle valve for

Note: flight prop reccommendations are dependent on airframe type.

Thunder Tiger Pro .40

Tower .40 R/C ABC—plain bearing

up their noses at bushings, but most of these will outlast certain cheap (inferior) ball bearings. Unfortunately, ball-bearing failure usually occurs after several hours of operation—beyond the scope of this comparative review.

Sound complicated? It really isn't, provided you understand the pluses and minuses associated with the technologies. A simple way to determine this is to check the materials and technologies used by the manufacturers of more expensive engines (Nelson, Jett, Rossi, YS, etc.), but don't be fooled. Sport flyers don't always need true chromed ABC engines with high-quality ball bearings. There's a big difference between running a high-dollar engine at 20,000+ rpm and a sport engine at 13,000. Don't be swayed by suggestions that ABC-type engines are superior to all others. Truth is—for sport engines—lapped iron and steel components and compression rings are more than satisfactory. Two advantages of ABC-type engines are: a relatively short break-in period and reduced chance of piston damage brought

Enya SS .40BB—ball bearing

safety. It runs well with a hotter glow plug, such as a McCoy MC-59.

Idle: fair @ 2,500rpm, with non-fuel-metering, air-bleed carburetor design.

Mid-range: excellent transition, due to a tiny carburetor bore.

Best props: 11x4, 10x6, 9x7.

■ SuperTigre GS .40 ($74.99)

This ringed engine has ball bearings and an aluminum alloy piston and press-fit steel cylinder. It requires a hotter glow plug, such as a K&B 1L. The GS .40 performed well throughout the tests.

Idle: fair @ 2,600rpm, with a fuel-metering carburetor.

Mid-range: good transition with some spitting (rich) at mid-range, with large-bore carburetor.

Best props: 11x5, 10x6, 9x7, 10x7.

■ Thunder Tiger GP-42 ($64.99)

This plain-bearing, ABN engine performed favorably compared to the other plain-bearing engines. It has a sweptback needle valve for safety.

Idle: fair @ 2,500rpm; about the best to be expected from a non-fuel-metering air-bleed carburetor design.

Mid-range: excellent transition through mid-range, due in part to a tiny carburetor bore.

Best props: 11x4, 10x6, 9x7.

■ Thunder Tiger Pro .40 ($84.99)

This ball-bearing, ABN engine has a sweptback needle valve. It performed well with some additional torque added from a partially tuned expansion-chamber muffler.

Idle: good @ 2,400rpm without loading fuel into the crankcase.

Mid-range: very good transition, with a slight richening at mid-range.

Best props: 11x5, 10x7, 10x6, 11x6.

■ Tower .40 R/C ABC ($54.95)

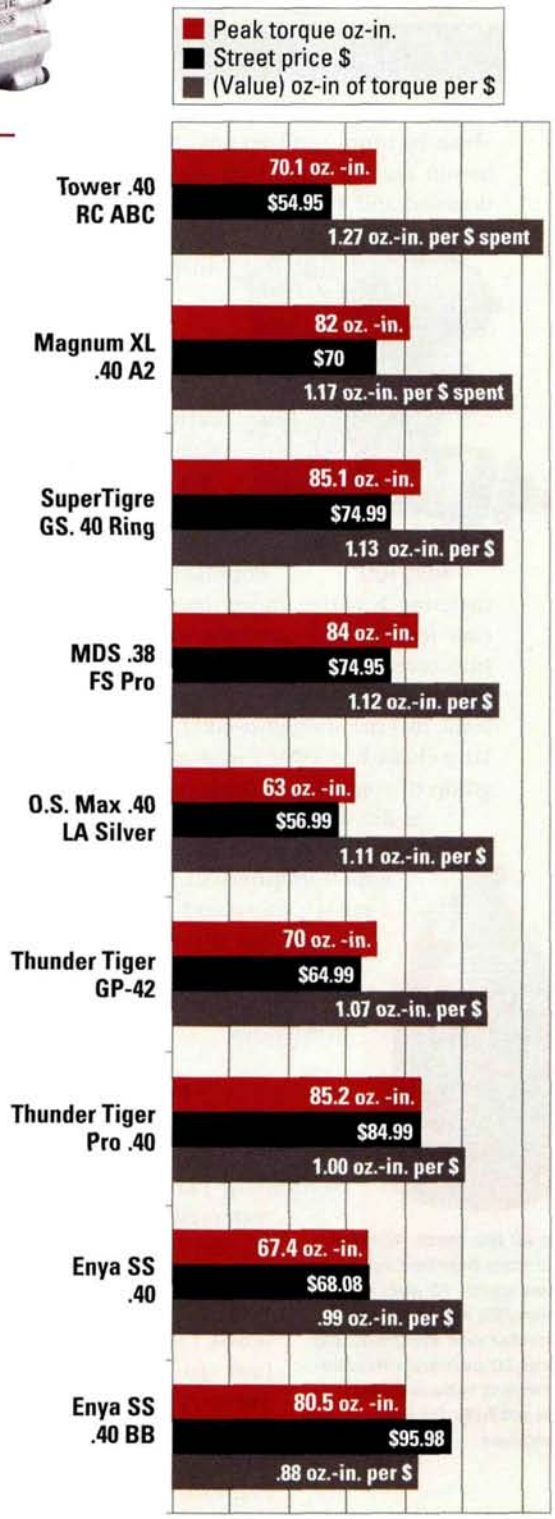
This plain-bearing ABC engine has a sweptback needle valve. The least expensive engine tested, it has the highest torque per dollar ratio.

Idle: fair @ 2,600rpm, with a non-fuel-metering air-bleed carburetor design.

Mid-range: excellent transition, due in part to a tiny carburetor bore.

Best props: 11x5, 10x6, 9x7, 9x6.

TORQUE PER DOLLAR SPENT



Comparison of rpm with various APC propellers

	RPM								
Prop	Enya SS. 40	Enya SS .40 BB	MDS .38 FS	O.S. Max .40 LA	SuperTigre GS .40	Thunder Tiger GP-42	Thunder Tiger Pro .40	Tower .40	Magnum XL .40
8x6	15,500	16,800	17,200	15,400	17,100	16,500	16,900	15,900	17,400
8x7	14,500	15,700	16,200	14,100	15,900	15,100	15,800	14,600	16,000
9x6	14,100	15,300	15,500	13,400	15,600	14,600	15,700	14,100	15,400
9x7	13,200	14,400	14,200	12,700	14,800	14,000	15,200	13,400	14,500
10x6	12,500	13,300	12,900	12,100	14,000	13,000	14,900	12,700	13,600
10x7	11,100	11,600	11,200	10,900	12,600	11,600	13,200	11,300	12,100
11x6	10,500	12,100	10,400	10,400	12,000	10,900	13,000	10,900	11,300
11x7	10,100	11,000	10,000	10,200	11,400	10,500	12,700	10,300	10,900
12x6	9,000	9,500	8,500	9,100	10,000	9,200	12,100	9,300	9,600
12x7	8,800	8,700	7,700	8,500	9,000	8,400	10,100	8,600	8,800

about by running a lean mixture setting. Properly broken-in and operated iron and steel assemblies have doubled and tripled the durability of certain ABC engines while maintaining their peak performance.

SuperTigre GS .40 Ring R/C

SIMPLIFYING THE SPECS

Study the engines' specifications (see table). Compare engine and muffler weights; notice the differences between carburetors (air-bleed or fuel-metering type). Popular opinion suggests that fuel metering is better; in my opinion, that isn't always the case; let's take the carburetor bore and cross-sectional area into consideration. Although most small-bore carburetors work nicely with single-needle air-bleed systems, some fuel metering (2-needle) units with relatively large choke bores don't work as well. Among this group of engines, the largest cross-sectional area is 2½ times greater than the smallest; not only is this a good indicator of which engine will produce the most power and torque (the largest) but also which will have the most difficulty idling and transitioning reliably (the largest) owing to fuel-mixture-control deficiencies.

In all the tests, Wildcat custom blended fuel was used: 10 percent nitro/20 percent lube (castor and synthetic oil) and 10 percent nitro/24 percent lube worked beautifully for all engines.

FUELING TIPS

Pay attention to the fuel used for each engine type. It's important to note that all fuel-component percentages are calculated and measured by volume—never by weight. Wildcat Fuels* was kind enough to supply me with two custom blends that worked beautifully for all the engines I tested. I used the 24-percent-lubrication fuel in all the iron and steel piston/cylinder engines and the ringed SuperTigre. All ABC-type combinations used the 20-percent-lubrication fuel—half castor oil and half synthetic. After break-in, I used less lubrication—20 percent for all except one iron and steel unit that also featured a bushed crankshaft bearing (with this, I used 24 percent for break-in and subsequent performance tests).

Magnum XL .40 A2

WHAT TO COMPARE

Don't pay much attention to the peak brake horsepower produced by these engines; it's meaningless for sport applications. You'll notice that the high horsepower levels are achieved with tiny propellers (APC* 8x6, etc.), none of which can be used with typical .40 sport models. High-horsepower, small-prop applications are the domain of racers and the far more sophisticated (and expensive) engines that are bolted into low-drag, high-speed airframes.

MDS .38 FS Pro

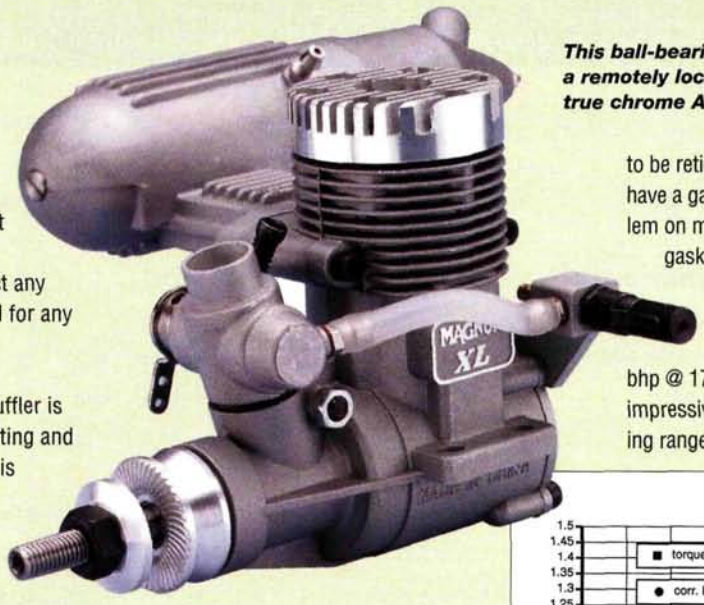
Enya SS .40—plain bearing

Torque is a more useful performance parameter for sport engines. Torque determines the size of the prop your engine is able to turn within a useful rpm range. If you're really interested in the true horsepower story, take the rpm value for a given prop on the chart above, and look up that value on the engine's power graph. Notice how much less power is generated at that rpm than is produced at the peak horsepower? Now check the torque for the same prop and rpm. You'll notice that for props used to fly sport planes, the rpm they turn put us closer to peak torque than brake horsepower.

For any sport engine, it's practical to look at peak torque per dollar invested (street price). For example, if the engine produces 100 oz.-in. of torque and costs $100, it generates 1 oz.-in. for each dollar spent.

Finally, compare the noise (decibel levels) of the engines. This is a useful indicator as to how well your new mill will be accepted at your flying field. Remember that every 3 decibels (dB) represents a doubling or halving of the perceived noise. Have fun comparing!

■ Magnum XL .40 A2



This ball-bearing Magnum XL .40 A2 has a remotely located needle valve and a true chrome ABC piston and cylinder.

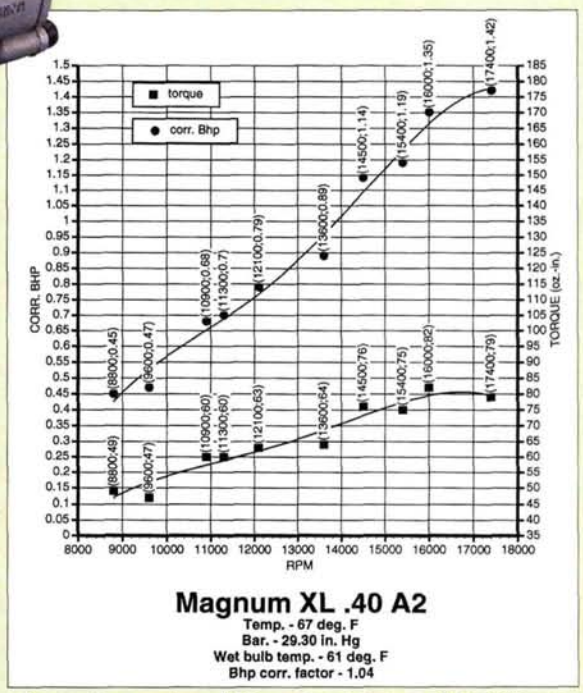
• **General impressions.** ABC cylinder seems remarkably similar to '70s ST units— Schnuerle and boost transfer ports; carburetor action is rough (barrel in carb housing); finish on crankshaft and piston is rough; I found a few aluminum chips inside. (You should inspect any new 2-stroke with its rear plate removed for any residual factory machining chips.)

• **Features.** Expansion chamber type muffler is fitted with an internal baffle, pressure fitting and a gasket; remote needle valve assembly is mounted off rear cover; engine is fitted with a removable back cover that's fitted with a gasket; a twin-needle fuel metering carburetor is sealed to the front of the crankcase with an O-ring; carburetor is held in the crankcase by a cinch bar; narrow squish band aluminum-alloy head is fitted with a soft aluminum gasket; true chrome plating used with the brass cylinder; piston contains high-silicon aluminum alloy; piston wristpin hole is blind-bored and has a Teflon end pad; the wristpin is press-fit into the piston; ST-type bar-stock aluminum connecting rod is bushed at both ends and has drilled oiling holes; crankshaft is held on the inner race of the front bearing by a truncated split-cone locking system (this maintains an interference fit at the rear of the drive washer); crankshaft is made of a single piece of steel and features a massive counterbalance; twin ball bearings (both shielded) support the crankshaft in the crankcase; the piston is interference-fit in the cylinder at top dead center in typical ABC fashion.

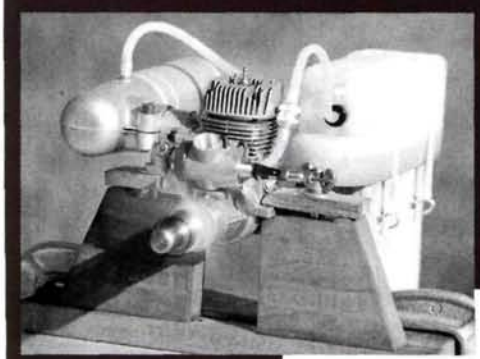
• **Performance.** Wildcat 10-percent nitromethane, 20-percent oil fuel; after only 20 minutes of break-in, the engine held a peak rpm needle setting without overheating— a significant advantage (you can get into the air more quickly). After that, engine immediately needled to a rich 2-cycle setting at which it was allowed to operate for approximately 2 minutes before being shut down for cooling. After several runs of this type, I peaked rpm for several seconds by momentarily pinching the fuel line. At the end of the procedure, the engine held a slightly rich peaked setting of 15,400rpm with the APC 9x6 break-in propeller.

At one point during break-in, the two-piece muffler came apart and had to be retightened. Since the mating surfaces didn't have a gasket, the joint leaked. This can be a problem on many 2-strokes; a simple fix is to form a gasket using high-temp silicone sealant.

In the performance graph, note that torque and horsepower peak at a very high rpm (82 oz.-in. @ 16,000 and 1.42 bhp @ 17,400). Although these absolute values are impressive, they occur beyond the practical operating range for most sport flying



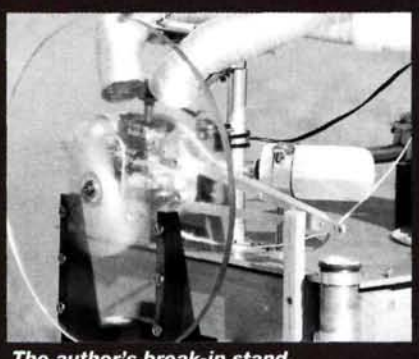
The engine produced 82 oz.-in. of torque at 16,000rpm. The horsepower at this rpm is 1.35. Depending on the type of airframe, the best flight propellers seem to be 10x6, 9x7 and 9x6.



An engine is torque-tested on the dyno.

Behind the scenes

I inspected and photographed the engines after I had read the instructions that came with each one. I mounted each engine on a stand, and after break-in, tested each proposed flight propeller's rpm. Then I mounted each engine in my dynamometer stand and tested it again. After I dismantled the engines and measured and checked their internals, I cleaned and photographed the parts then reassembled them. How long did all of this this take? Approximately 118 hours!



The author's break-in stand.

A disassembled O.S. Max .40 LA.

SPECIFICATIONS

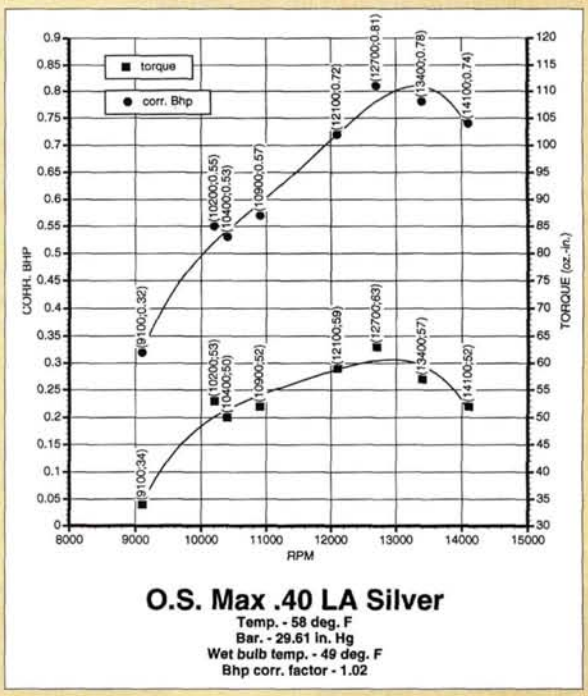
	Enya SS .40	Enya SS .40 BB	Magnum XL .40 A2	MDS .38 FS Pro	O.S. Max .40 LA Silv
Cylinder bore and stroke (mm)	20.9x18.9	20.9x18.9	20.66x19.28	21.0x18.1	21.2x18.4
Displacement	0.396ci	0.396ci	0.40ci	0.38ci	0.396ci
Engine weight w/muffler	14.1 oz.	15.2 oz.	16.4 oz.	15.7 oz.	12.6 oz.
Muffler	Enya M402X	Enya M402X	Baffled expansion- ch. type	Expansion-ch. type	Baffled exp. ch. type
Carb. type	Enya Type G	Enya 2-needle	Twin-needle fuel metering	Twin-needle fuel metering	Air-bleed type
Carb. bore and cross-sectional area	0.238 in./0.044 in.^{2}	0.295 in./0.068 in.^{2}	0.295 in./0.068 in.^{2}	0.315 in./0.078 in.^{2}	0.220 in./0.038 in.^{2}
Crankshaft nose thread	¼-28	¼-28	¼-28	¼-28	¼-28
Fuel (break-in/ running)	10% nitro, 24% lube	10% nitro, 24%/20% lube	10% nitro, 20% lube	10% nitro, 20% lube	10% nitro, 20% lube
Glow plug	Enya no.3	Enya no. 3	Not supplied (K&B 1L used)	Supplied (not known)	Not supplied (see text
Idle rpm (best reliable after break-in)	2,500	2,500	2,700	2,500	2,500
Sound level (decibels)	97 @ 14,100	98 @ 14,400	95 @ 14,500	94.5 @ 14,200	94 @ 14,100
Peak torque	67.4 oz.-in. @ 14,500	80.5 oz.-in. @ 14,400	82 oz.-in. @ 16,000	84 oz.-in. @ 16,200	63 oz.-in. @ 12,700
Peak bhp (corrected)	1.01 bhp @ 15,500+	1.27 bhp @ 16,800	1.42 bhp @ 17,400	1.38+ bhp @ +17,200	0.78 bhp @ 13,400
Warranty	5-year (full to limited)	5-year (full to limited)	2-year (limited)	3-year (limited)	2-year (limited)
Est. street price	**$68.08**	**$95.98**	**$70**	**$74.95**	**$56.99**

■ O.S. Max .40 LA Silver—plain bearing

This plain-bearing O.S. Max .40 LA Silver has a remotely located needle valve, an ABN piston and a thin-wall cylinder.

• General impressions. As is usual for O.S. products, a high degree of machining excellence (casting, grinding, honing, turning and milling); an extremely thin cylinder wall (0.030 inch); provisions were made in the crankcase for a boost transfer port bypass passage, but none was machined or cast in place; cylinder porting consists of two Schnuerle transfer ports and a single exhaust; engine was very clean inside; no gaskets were included for the two-piece muffler or its interface with the exhaust stack ... and none were needed; the components fit so closely that nothing leaked.

• Features. Expansion chamber muffler fitted with an internal cone-type baffle, and pressure fitting; a remote rear cover mounted needle valve assembly; rear cover is molded from reinforced-plastic—one piece, includes gasket; air-bleed type carburetor (40D) with O-ring seal to front of crankcase; carburetor is held on the front of the crankcase by two 180-degree opposed Phillips-head machine screws; the cylinder head, retained by four machine screws, is of the wide-squish-band variety with a soft aluminum gasket; the cylinder is rotated 45 degrees clockwise (viewed from the head side of the engine); the thin-wall brass cylinder is nickel-plated and has Schnuerle porting (no boost); the lapped piston is made of high-silicon aluminum alloy; the wristpin is free-floating and is fitted with two Teflon end pads to prevent cylinder scoring; the connecting rod is machined from bar-stock aluminum alloy and is bronze bushed at both ends before being drilled with lubrication holes; the crankshaft is produced in one piece; the shaft portion of the crankcase is bronze bushed for support; an interference fit between the piston and cylinder at top dead center is evident, indicating the use of a typical tapered cylinder.



O.S. Max .40 LA Silver
Temp. - 58 deg. F
Bar. - 29.61 in. Hg
Wet bulb temp. - 49 deg. F
Bhp corr. factor - 1.02

The engine produced 63 oz.-in. of torque at 12,700rpm. The horsepower at this rpm is 0.81. Depending on the type of airframe, the best flight propellers seem to be 11x4, 10x6 and 9x7.

• Performance. Wildcat 10-percent nitromethane, 20-percent-oil fuel; break-in was achieved with an undersize APC 9x6 reinforced-plastic propeller.

The engine started easily and was immediately needled to a rich 2-cycle setting. After 20 minutes (total), the engine ran roughly and rattled—possibly because of a combustion defect such as detonation— when peaked to maximum rpm. I changed from the K&B 1L glow plug to a hotter McCoy MC-59 hoping to solve the problem. Although the noise subsided, it was still there. I decided on extra break-in to see what would happen; after 15 minutes of running, the condition had disappeared. Who said that break-in was a waste of time?

Although the .40 LA operated smoothly during the torque tests, its overall performance was disappointing. Part of this can be attributed to the carburetor's tiny choke diameter.

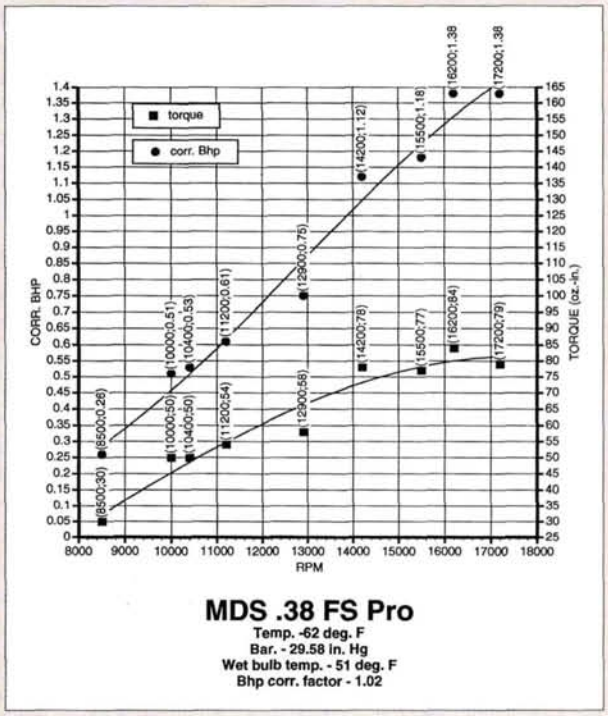
	SuperTigre GS .40	Thunder Tiger GP-42	Thunder Tiger Pro .40	Tower .40 R/C ABC
Cylinder bore and stroke (mm)	0.846x0.701	Not applicable	20.9x19.0	Not applicable
Displacement	0.39ci	0.42ci	0.398ci	0.40ci
Engine weight w/muffler	18.26 oz.	12.5 oz.	16.6 oz.	11.5
Muffler	ST Silent	Thunder Tiger	Baffled, expansion ch.	Tower no. TOWG4720
Carb. type	ST Mag	Air-bleed type	2-needle, fuel metering	Tower no. TOWG4100
Carb. bore and cross-sectional area	0.350 in./0.096 in.^{2}	0.220 in./0.038 in.^{2}	0.295 in./0.068 in.^{2}	0.240 in./0.045 in.^{2}
Crankshaft nose thread	¼-28	¼-28	¼-28	¼-28
Fuel (break-in/ running)	10% nitro, 24%/20% lube	10% nitro, 20% lube	10% nitro, 20% lube	10% nitro, 20% lube
Glow plug	SuperTigre and K&B 1L	Not supplied (K&B 1-L used)	Not supplied (K&B 1L used)	Not supplied (K&B 1L used)
Idle rpm (best reliable after break-in)	2,600	2,500	2,450	2,600
Sound level (decibels)	94 @ 14,000	94 @ 14,000	95.5 @ 14,600	95 @ 14,100
Peak torque	85.1 oz.-in. @ 14,800	70 oz.-in. @ 14,000	85.2 oz.-in. @ 13,600	70.1 oz.-in. @ 14,100
Peak bhp (corrected)	1.36 bhp @ 17,100	1.11 bhp @ 16,500	1.29 bhp @ 16,000	1.02 bhp @ 14,600
Warranty	2-year (limited)	3-year (limited)	3-year (limited)	2-year (limited)
	$74.99	**$64.99**	**$84.99**	**$54.95**

■ MDS .38 FS Pro

• **General impressions.** Smooth-acting throttle-barrel carburetor; rough cylinder-port machining (chromed-over burrs); bead-blasted exterior, including the muffler.

• **Features.** Large, heavy (4.6-ounce) expansion chamber muffler with pressure fitting but no exhaust stack gasket; twin-needle fuel metering carburetor with O-ring seal and a unique cinch-clamp way of attaching it to the crankcase; squish-band-type head with soft aluminum gasket; truncated split cone attaches the drive washer to the crankshaft; O-ring-sealed rear cover (difficult to remove); ABC cylinder and piston construction with a heavy wall cylinder (0.080 inch); high silicon aluminum alloy lapped piston; full-floating wristpin is held by two music-wire clips in the piston; the SuperTigre-type bar-stock aluminum-alloy connecting rod is bushed only on the crankpin end; one-piece crankshaft; twin ball-bearing-supported crankshaft with dust shield on the front unit; lower crankcase is grooved; the supplied idle-bar glow plug is only intended for break-in. The instructions state, "It's common for these plugs to burn out within several runs of the engine." I'd prefer to have the engine sent out without a plug, as other manufacturers do.

This ball-bearing MDS .38 FS has a large expansion-chamber muffler and a true chrome ABC piston and cylinder.



MDS .38 FS Pro
Temp. -62 deg. F
Bar. - 29.58 in. Hg
Wet bulb temp. - 51 deg. F
Bhp corr. factor - 1.02

The engine produced 84 oz.-in. of torque at 16,200rpm. The horsepower at this rpm is 1.38. Depending on the type of airframe, the best flight propellers seem to be 10x5.5, 9x7 and 9x6.

• **Performance.** Wildcat 10-percent nitromethane, 20-percent lube fuel; break-in propeller—APC 9x6. After the first start-up and needling to a rich 2-cycle setting, I noticed that the muffler/exhaust-stack interface leaked. Again, this could be fixed with high-temp silicone sealant. As predicted in the instructions, the idle-bar glow plug burned out after only 7 minutes of running. I replaced it with a McCoy MC-59 non-idle-bar unit. The engine required a 15-minute break-in to a point at which it held a peaked needle setting without overheating. At this point, it turned the 9x6 propeller at 15,500rpm.

Torque tests revealed that maximum torque and horsepower were achieved at very high rpm—beyond the speed range of the average sport model.

The MDS appears more suited to use as a high-speed racing engine; tiny propellers and low-drag airframes could make full use of its power. For example, if you look at the 10x6 prop (recommended for the .38) in terms of rpm (12,900), torque (67 oz.-in.) and brake horsepower (0.88), the engine operates at below its stated potential.

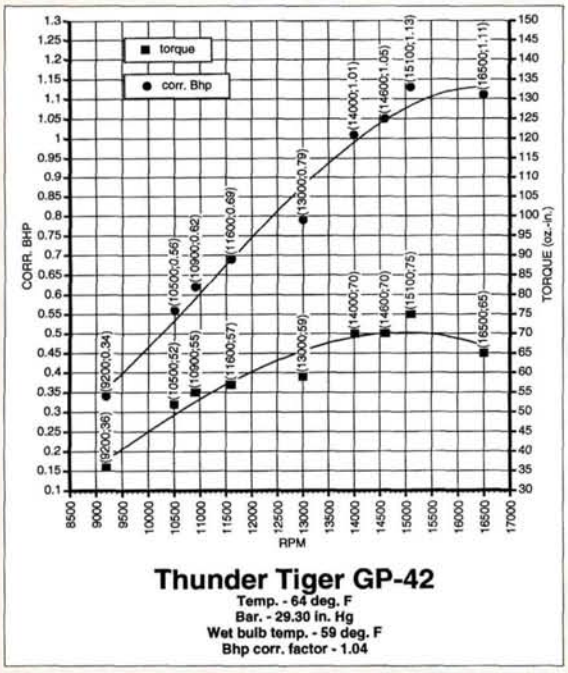
■ Thunder Tiger GP-42—plain bearing

The plain-bearing Thunder Tiger GP-42 has a swept-back needle valve (for safety) and an ABN piston and cylinder.

• **General impressions.** Above average castings, machine work and finish on all components. Excellent attention to detail, e.g., bushings, gaskets and deburring of components. Interference fit between piston and cylinder at top dead center, indicating a tapered cylinder with consistent, precise tolerances; ABN (aluminum piston with nickel plated brass cylinder). Allen-head capscrews used throughout (one was completely loose on the rear cover—check this periodically on all of your engines!); engine was very clean inside.

• **Features.** Bolt-on air-bleed carburetor (similar to that on the Fox); swept-back needle valve; squish-band cylinder head retained by four machine screws; nickel-plated brass cylinder; two Schnuerle ports and a single boost transfer port; 45-degree rotation on the cylinder as viewed from the top; cast aluminum alloy, high-silicon-content lapped piston; single Teflon pad for rear-facing wristpin end. The other end of wristpin sits in a blind-bored seat within the forward facing piston boss; an alignment pin in the top of the crankcase keys with the cylinder to ensure perfect internal positioning of the ports; bar-stock aluminum alloy connecting rod is brass bushed at both ends and drilled for lubrication; one-piece crankshaft is incorporated; a bronze bushing is used for crankshaft support; a baffled expansion-chamber muffler with pressure fitting and exhaust stack gasket is provided. Also, an O-ring sealing gasket was provided between the two halves of the muffler body to prevent exhaust residue from becoming a problem.

• **Performance.** Wildcat 10-percent nitromethane/20-percent lube; break-in prop—APC 9x6; engine was started and needled to a rich 2-cycle. Performance data revealed that the Tiger .42 peaked at 14,000rpm for torque and 16,500rpm for brake horsepower. Although a bit fast for typical sport airplanes, individual propellers compared favorably with other engines in this plain bearing category—especially when the tiny (0.220-inch) carburetor choke diameter is taken into consideration.



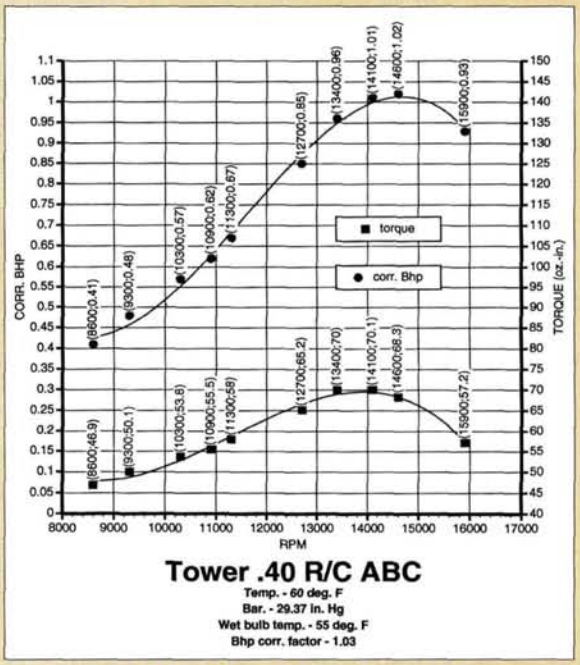
The engine produced 70 oz.-in. of peak torque at 14,000rpm. The horsepower at this rpm is 1.01. Depending on the type of airframe, the best flight propellers seem to be 11x4, 10x6 and 9x7.

■ Tower .40 R/C ABC—plain bearing

A plain-bearing Tower .40 R/C ABC with swept-back needle valve; it features a true chrome ABC piston and cylinder.

• **General impressions.** Nice machine work; no chips or dirt inside; clean; extremely crisp cylinder-port machining and chrome plating; piston has minimum wristpin boss material for support.

• **Features.** Expansion-chamber type muffler with pressure fitting and no gasket provided between muffler and exhaust stack; air-bleed type carburetor with swept-back needle-valve assembly and O-ring seal between carburetor neck and front of the crankcase; squish-band combustion chamber cylinder head retained by six Allen-cap-type machine screws; rear cover is held by four Allen-cap-type machine screws (gasket included); crankshaft has a hardened and ground steel washer behind the drive washer to absorb crankshaft axial thrust (starter motor application); high-silicon-content cast-aluminum alloy lapped piston with chrome-plated brass cylinder (ABC); cylinder porting consists of two Schnuerle transfers and a single boost; free floating, hardened and ground steel wristpin with Teflon end pads; the connecting rod is of the SuperTigre type with two bronze bushings and drilled lubrication holes; crankshaft is one piece with a ¼-28 nose thread; crankshaft is supported by a bronze bushing within the crankcase casting; the cylinder is music-wire pin aligned with the top of the crankcase; an interference fit of the piston top to the tapered cylinder occurs at top dead center.



The engine produced 70.1 oz.-in. of torque at 14,800rpm. The horsepower at this rpm is 1.01. Depending on the type of airframe, the best flight propellers seem to be 11x5, 10x6, 9x7 and 9x6.

• **Performance.** Wildcat 10-percent nitromethane and 20-percent lubricant fuel was used for all break-in and performance testing. An APC 9x6 propeller was used for break-in; a K&B 1L glow plug was used for all tests. This engine produced some of the cleanest ("textbook") torque and bhp curves of the combined testing sessions.

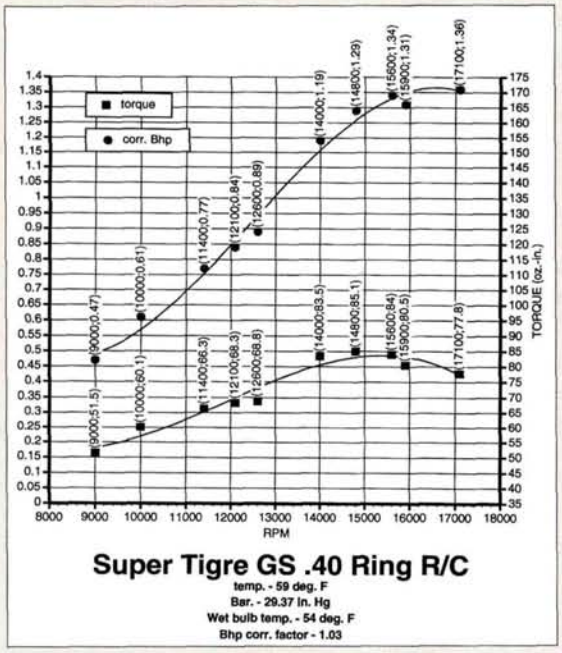
■ SuperTigre GS .40 Ring R/C

• **General impressions.** Cylinder is press-fit into the crankcase; to extract it, heat had to be applied to the crankcase. When installed at the factory, the cylinder badly scored its interface with the crankcase, causing a series of rolled-up burrs.

The crankcase has huge transfer and boost port bypass channels. The skirt on the single-ring aluminum alloy piston is heavily cross-hatched for oil retention. The hardened steel cylinder is ground and honed with little or no cross-hatching. Of the-nine engines, the SuperTigre (ST) Mag carburetor has the largest choke diameter/cross-section.

This ball-bearing SuperTigre GS .40 Ring R/C has a large, positionable expansion-chamber muffler, a hard steel cylinder and a ringed, aluminum-alloy piston.

• **Features.** The large, heavy muffler has a positionable fitting off its round header pipe; muffler comes complete with pressure fitting and header to exhaust stack gasket; muffler header pipe fastens to engine crankcase with two bolts and nuts; muffler fastens to the header with an integral clamp-ring; Mag carburetor is a large—2-ounce—2-needle fuel metering unit with a positionable output arm; the cylinder head has large fins and a squish-band combustion chamber; head is outfitted with a bronze glow-plug thread insert and a copper gasket; an O-ring seal is used for the rear cover; the aluminum alloy piston is equipped with a single cast iron (meehanite) compression ring, which is immobilized at its end-gap by a radial music-wire pin pressed into a small hole within the ring groove; the cylinder porting consists of two conventional Schnuerle transfers with a single boost supplemented by two flow-control ports; the hardened and ground steel wrist-pin is retained within the piston by two music-wire clips; the connecting rod is a standard ST bar-stock aluminum alloy unit with bronze bushings at both ends, including the appropriate oil holes; the crankshaft is a one-piece unit; drive washer is retained on the crankshaft by a truncated split cone; twin ball bearings support the crankshaft.



The engine produced 85.1 oz.-in. of torque at 14,800rpm. The horsepower at this rpm is 1.29. Depending on the type of airframe, the best flight propellers seem to be 11x5, 10x6, 10x7 and 9x7.

• **Performance.** Break-in was accomplished with Wildcat 10-percent nitromethane fuel and 24-percent lubricant. The standard APC 9x6 propeller was used throughout. Because the Tigre is a ringed engine, break-in procedures are similar to those used with the lapped steel and iron engines: short running periods (3 minutes) at a rich 4-cycle to maintain a cool and oily condition. Because the engine refused to continue running after the glow heat had been removed, I replaced the SuperTigre glow plug with a hotter K&B 1L; this solved the problem. After 45 minutes of running (using the pinch technique to briefly elevate rpm into the 2-cycling mode of operation), the engine began showing signs of improvement. Shortly, it held a peaked needle setting without sagging.

Dynamometer torque tests and propeller rpm determination were performed with Wildcat 10-percent nitromethane and 20-percent lubricant fuel. These tests confirmed that the Tigre .40 was performing admirably.

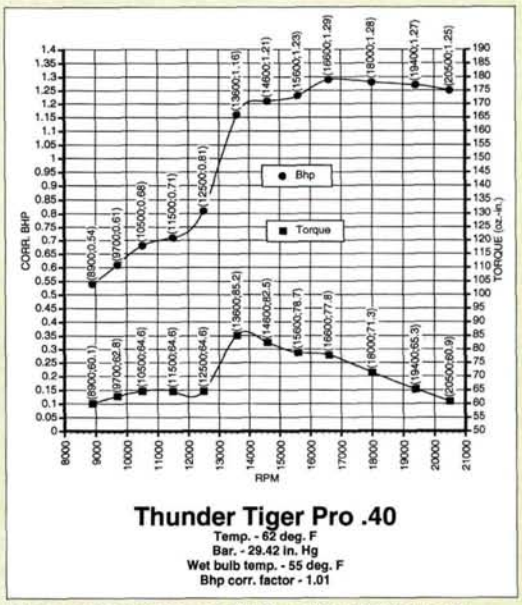
■ Thunder Tiger Pro .40

• **General impressions.** Beautiful machine work and castings; high attention to detail (gaskets, finish, etc.); precise (interference) fit between piston and tapered cylinder at top dead center; high squish-band angle on cylinder head; clean, chip-free interior; initial inspection revealed that the rear cover machine screws were loose.

This ball-bearing Thunder Tiger Pro .40 has a non-swept needle valve and an ABN piston and cylinder.

• **Features.** Baffled, expansion chamber muffler with pressure fitting and gasket; 2-needle-valve fuel metering carburetor retained to crankcase intake manifold by a cinch-bar-type fastener; O-ring seal between carburetor and crankcase; squish band cylinder head with six machine screws; soft aluminum head gasket; gasket between rear cover and crankcase; cylinder is nickel-plated brass with two Schnuerle and one boost transfer port; silicon aluminum-alloy piston completes the ABN set; SuperTigre-type connecting rod with brass bushings at each end and drilled lubrication holes; one-piece crankcase; twin ball-bearing supported crankshaft; split tapered cone drive washer lock to crankshaft; blind-bored piston for free-floating wristpin, retained by a music-wire clip; Allen-cap machine screw fasteners are used throughout; top of the crankcase is pinned for cylinder location.

• **Performance.** The 10-percent nitromethane/20-percent lubrication fuel was used for all break-in and torque testing. Accepted ABC-type break-in procedures were applied for 30 minutes. Dynamometer testing produced an unusual torque and brake horsepower graph; torque jumped beginning at 12,500rpm. This trend can be attributed to the tuning effect of the expansion chamber muffler in conjunction with the design specifications of this engine. This was probably serendipitous but resulted in flight propellers turning higher rpm than otherwise expected. Although I didn't have time to experiment, the best propeller might be the APC 10x7 trimmed in diameter to about 9.75 or 9.50 inches (allowing it to "jump up on the pipe").



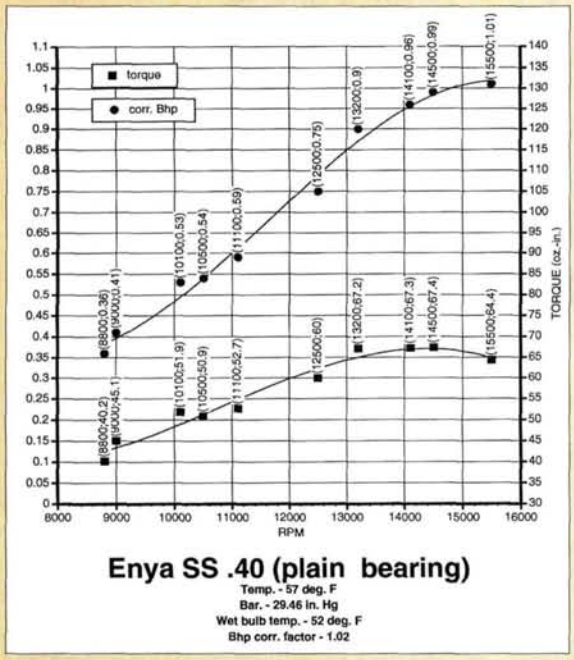
The engine produced 85.2 oz.-in. of torque at 13,600rpm. The horsepower at this rpm is 1.16. Depending on the type of airframe, the best flight propellers seem to be 11x5, 10x7,10x6 and 11x6.

■ Enya SS .40—plain bearing

A plain-bearing Enya SS .40 with swept-back needle-valve; it has an iron piston and a steel cylinder so it requires a longer break-in.

• **General impressions.** High-quality castings, materials and machine work; attention to detail is evident in items such as gaskets, bushed connecting-rod ends and the threaded-brass cylinder-head insert for the glow plug (these suggest good performance). The steel and iron lapped cylinder and piston set requires a relatively long break-in with a higher percentage of castor oil. The bronze-bushed crankshaft support is as good as a ball bearing unit as long as the engine is always given enough lubrication. The removable front crankcase housing requires more machine work than the more common one-piece crankcase and removable back cover.

• **Features.** Expansion-chamber-type muffler with pressure fitting; gasket between muffler and exhaust stack; fuel-metering single-needle carburetor with air-bleed mixture adjustment; swept-back needle-valve assembly for safety; carburetor is sealed to the front housing with an O-ring-; carburetor is held on the front housing by two 180-degree opposed machine screws; removable front-end housing (no back cover); all fasteners are Allen-cap type; one-piece crankshaft (no pressed-in crankpin); gasket interface between front crankcase housing and crankcase; bronze-bushed crankshaft support; bushed connecting-rod ends; threaded-brass cylinder-head insert for glow plug; hardened, ground and honed (tapered) steel cylinder; two Schnuerle transfer ports with boost port opposite exhaust; wristpin is held on the piston by two music-wire clips; piston is the lapped cast-iron variety; provision at the rear of crankcase for pressure fitting; interference-fit between piston and cylinder at top-dead-center (unusual for a steel and iron piston and cylinder set).



The engine produced 67.4 oz.-in. of torque at 14,500rpm. The horsepower at this rpm is 0.99. Depending on the type of airframe, the best flight propellers seem to be: 11x4, 9x7 and 9x6.

• **Performance.** Easy first start and run at a rich 4-cycle with APC 9x6 break-in prop; 10-percent nitromethane/24-percent lube. After 12, 3-minute rich runs (with cool-down between runs), the engine held a steady peaked needle setting at 14,100rpm. Enya suggests that up to three hours of careful operation may be required for complete break-in. Torque tests ran with 24-percent-lubrication fuel.

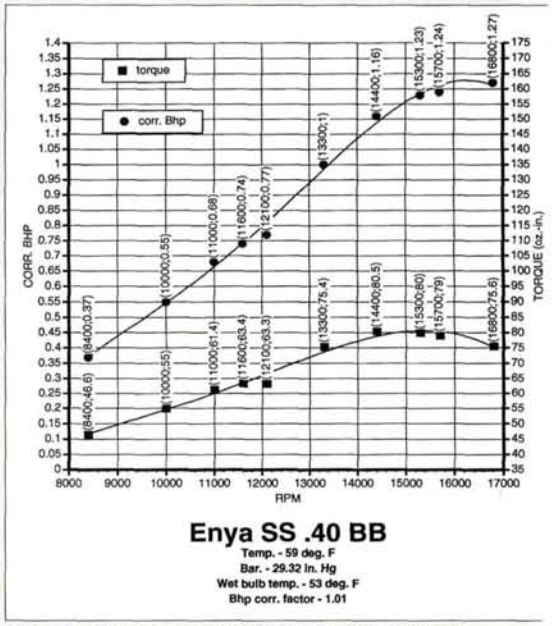
■ Enya SS .40 BB—ball bearing

This ball-bearing Enya SS .40 has a swept-back needle valve and a meehanite iron piston and steel cylinder (requires a longer break-in).

• **General impressions.** High-quality castings, materials and clean machine work (no chips left inside); attention to detail is evident in gaskets, bushed connecting rod ends and the threaded brass glow plug cylinder-head insert. The steel and iron lapped cylinder and piston set requires a relatively long break-in with a higher percentage of castor oil in the fuel. The ball-bearing-supported crankshaft suggests that after break-in, good performance and longevity can be expected with less lubrication (20 to 22 percent). The removable front crankcase housing requires more machine work than the more usual one-piece crankcase and removable back cover.

• **Features.** Expansion-chamber-type muffler with pressure fitting and gasket between muffler and exhaust stack; twin-needle-type, fuel-metering carburetor with angled-back needle valve; carburetor is held on the front housing by two Phillips-type machine screws; synthetic rubber gasket between the housing and carburetor body; crankcase housing is removable; crankcase is unusual—one-piece unit without a removable rear cover; provision is made for a pressure fitting at the rear of the crankcase; narrow squish-band head with brass glow-plug threaded insert is an interesting touch; twin ball-bearing-supported crankshaft; one-piece crankshaft with ¼-28 nose thread; internally tapered steel cylinder (hardened, ground and honed); cast-iron piston (no baffle) with two music-wire clips holds the wristpin; bronze-bushed cast-aluminum-alloy connecting rod (both ends) with oil holes; two Schnuerle cylinder transfers with single boost port; interference-fit between piston and cylinder at top dead center—unusual for an iron and steel setup.

• **Performance.** Easy start and first run at very rich 4-cycle with 24-percent lube; very steady operation during early break-in; no loss of rpm when glow heat was removed, (indicates a good piston-to-cylinder seal and the correct glow-plug-heat range). After 15 minutes of very rich 3-minute runs to allow a complete cooling and heating cycle, I leaned the engine to a fast 4-cycle. During the next 15 minutes, I pinched the fuel line occasionally to elevate rpm toward the 2-cycling peak. After 30 minutes, the engine wouldn't hold a peaked setting without overheating; I had to run it rich for 15 more minutes before it would maintain a slightly rich peaked setting (15,300rpm with APC 9x6 propeller). Enya suggests that a complete break-in may take as long as three hours. Torque tests were conducted with 20 percent lubricant in the fuel mixture.



The engine produced 80.5 oz.-in. of torque at 14,400rpm. The horsepower at this rpm is 1.16. Depending on the type of airframe, the best flight propellers seem to be 11x5, 10x6 and 9x7.

**The addresses of the companies mentioned are listed alphabetically in "Featured Manufacturers" on page 150.*

GREAT PLANES

AT-6 TEXAN

by Vic Olivett

The AT-6 Texan has been a favorite subject of experienced modelers for many years because of its classic lines and historic significance. Thanks to Great Planes*, everyone can now experience the excitement of this famous warbird in an easy-to-build .40-size ARF. Almost 60 years ago, the Texan was used to train the young pilots who fought in the skies over Europe and the Pacific. The Great Planes Legendary Warbirds series AT-6 .40 ARF will have a new generation of pilots flying this classic plane and enjoying the many scale details, the acrobatic yet forgiving flight performance and the easy construction that a state-of-the-art ARF can provide.

SPECIFICATIONS

Model: AT-6 ARF

Manufacturer: Great Planes

Type: High-performance sport-scale warbird

Wingspan: 59.8 in.

Wing area: 557.6 sq. in.

Wing loading: 23.1 oz.-sq. ft.

Weight: 5.8 to 6.3 lb. (6 lb., 12 oz., as built)

Length: 42.14 in.

Engine: .40 to .51 2-stroke or .48 to .80 4-stroke

Engine used: O.S .70 Surpass 4-stroke

Radio req'd: 4-channel w/5 servos, 5-channel w/6 servos if retracts are used

Features: all wood construction, covered with MonoKote, painted fiberglass and molded plastic parts, all needed hardware, detailed and well-illustrated instructions.

Comments: nice scale detail, solid construction and delightful flight performance, all in an easy-to-assemble package. This plane flies like a sport model while maintaining many of the scale details of the original Texan.

Hits
- Great workmanship.
- Excellent instruction manual.
- Prepainted parts.

Misses
- MonoKote lifts from surface in some areas.

The AT-6 kit is complete right out of the box. The construction is almost entirely wood, and the plane is covered in colorful MonoKote*. The fiberglass cowl and all of the ABS parts have been painted. Fixed landing gear is included, and the Texan has been designed to accept Hobbico* retracts (part no. HCAP4010). The kit comes with all necessary hardware except what is required for the retracts. The instruction manual is well-illustrated and has many helpful hints.

Everything you'll need except a radio, an engine and the glue is in the box. Retracts are optional, since fixed-gear hardware is supplied. I recommend fixed gear if you fly off anything other than a paved or well-manicured grass field. Moderate to rough grass fields will be a problem for retract use.

WING ASSEMBLY

The first step is to remove the covering from the aileron servo openings on the bottom of the wing. Great Planes has installed a temporary pull-string you can use to pull the servo extension wire through the wing panel; there is also a string in the wing's center section. Join the outer wing panels on each side of the center section by using a pair of the hardwood wing joiners that come with the kit. The two pairs of joiners—one for each side—are preset at the proper dihedral. Test-fit the wing panels a few times to ensure proper fit; then epoxy them. Remove any excess epoxy with alcohol and a paper towel. After the wing epoxy has cured, fit it to the fuselage and align it with the tail post. Then, fasten it to the fuse using the bolts included in the kit. The wing's bottom has open bays for the aileron servos. Fasten the servos to the servo-bay cover plates and then mount the covers in the bays with four screws.

The kit comes with fixed, bent-wire landing gear but is designed to accept optional Hobbico mechanical retracts. The wheel wells and mounting rails are already installed, so I opted for the retractable gear (see "To Retract or Not to Retract," below).

TAIL ASSEMBLY

The fuselage's rear comes notched for both the vertical fin and the stabilizer. After removing the covering on the fuse, stab and fin, align them with the wing

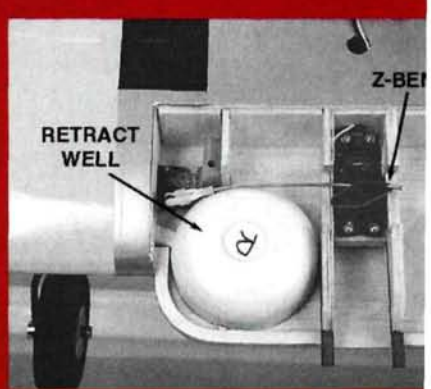
TO RETRACT OR NOT TO RETRACT

For the most part, retract linkage setup on the Texan is fairly simple. Bending the struts so the wheels retract fully into the wells without binding on their sides, however, does take a bit of patience—so, be patient. The gear strut has to be bent to a pattern illustrated in the instruction manual.

A pair of vacuumed-formed wheel wells is included with the Texan. Install them by first removing the covering over the wheel-well cutout in the bottom of the wing and then gluing the wheel well into place with a little medium CA. Keep in mind that you have a right and a left well.

With the gear installed and the retract servo in place, you can make the adjustments to the pushrods for the proper clearance and operation. Remember, it's very important that the gear lock in both the up and down positions without stalling the servo. Once you are satisfied with the installation, you can glue the ABS center-section cover into place.

Although Hobbico's mechanical retract units function quite well, and they do fully lock in both retracted and deployed positions, I recommend you forgo retracts altogether and opt for the fixed gear if you fly off a grass field that is even a bit on the rough side. It's not that the retract unit can't take a bit of a beating; it can, and it never gave me any problems. It's simply that if the gear struts get bent even slightly, the wheels will not line up in the wells properly, and this will prevent full retraction. If, on the other hand, you fly off pavement or well-groomed grass, by all means, go for the retracts.

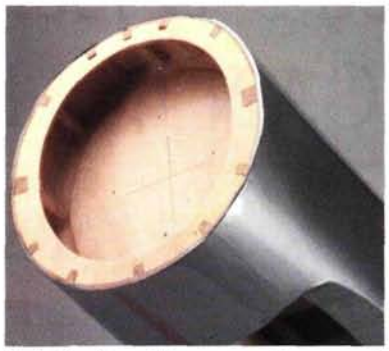


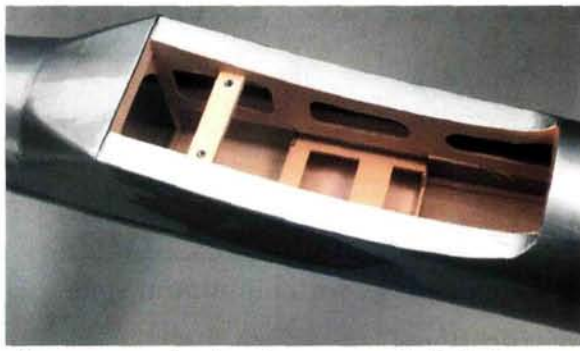
and epoxy them in place. After the stab and fin have cured, fit the rudder, the elevators and the tailwheel assembly. The pushrods come installed and ready to attach to the servos.

THE FUSELAGE

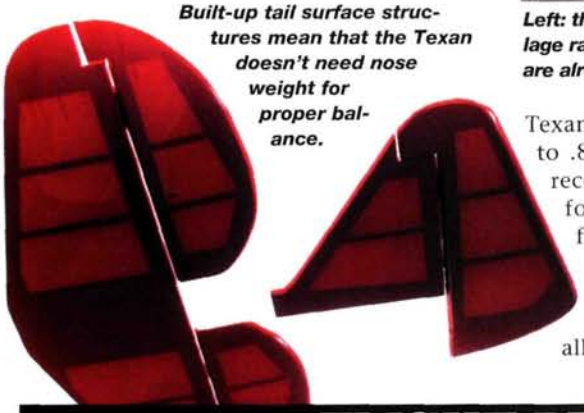
The instruction manual includes a template for the engine mount. I chose an O.S.* .70 Surpass 4-stroke to power my Texan, but any .40 to .51 2-stroke or .48 to .80 4-stroke will do. The firewall is recessed just behind the front of the forward section's outer ring of the fuse. Use four 6-32 bolts and blind nuts to bolt the adjustable engine mount to the firewall.

When you mount the engine, allow 4½ inches from the back of the engine mount to the engine's thrust plate for proper cowl clearance. I used four 6-32 socket-head bolts and locknuts to hold the engine in the mount instead of the four sheet-metal screws included in the kit. Holes are marked for the throttle pushrod, but remember to roughen the outside of the pushrod to give the glue some texture to bond to.





Left: the firewall is recessed for correct scale nose moment and cowl appearance. Right: the fuselage radio compartment just as it comes out of the box. The servo tray and wing hold-down plate are already in position—plenty of room in there.



Built-up tail surface structures mean that the Texan doesn't need nose weight for proper balance.

FLIGHT PERFORMANCE *by Chris Chianelli*

I don't know about you, but for me, the in-flight visibility factor of a model is a big part of how easy—or difficult—it is to fly. With its yellow wings and red markings, the AT-6 is a very easy model to keep tabs on in flight. Loss of orientation when flying military aircraft that are often finished in varying combinations of olive drab, tan, dark blue, sky blue and dove-gray can be a visibility problem for many. This is not the case with the Texan, since Great Planes chose the bright scheme of an Army Air Corps trainer.

• DOWN TO BUSINESS

OK; visibility aside, how does it fly? With its high aspect ratio wing and sport-plane airfoil—very nicely. Even on the first flight, after minor down- and left-aileron trim, I immediately felt secure enough with the characteristics of the Texan to deliver close-in and slow passes for Walter's Nikon. That doesn't mean, however, that you can slow this one up like a fun-flyer; you can't. The wing will stall, but only at very low speeds; much lower than would seem appropriate for a warbird, even an advanced trainer-type warbird. The thing I liked most about the Texan is that it doesn't need any in-flight trim-setting changes from low speed to flat out. Some designs, for example, need elevator trim changes from high-speed to landing-speed transition. There's nothing wrong with that; it's just the way some designs are. I love it, however, when a model tracks the same at all throttle settings, and that's what the Texan does. This doesn't, of course, include gear-up and gear-down elevator trim changes. With the gear tucked away, every retract-equipped model I've ever flown needs down trim, and this one is no exception. Conversely, up-elevator trim is needed when the gear's parasitic drag is reintroduced into the airstream.

All basic aerobatics are possible with this model; however, maneuvers requiring top rudder would be a stretch. I tried a knife-edge and it was, at best, a dubious undertaking. Anyway, that's not what a Texan does. Smooth flying and, with that high aspect ratio wing, gracefulness on the roll axis is what a Texan is all about. Rolls were very positive, albeit slightly barreled. Stall-maneuver recovery is quick, and the Texan gets right back on heading very quickly and tracks through the sky in bright-colored beauty. It's a very enjoyable model to fly.

The Surpass .70 is about as much power as you'd want to put in this model. It's not over-powered—but it *is* at its practical limit. Any good .60-size 4-stroke would do nicely. I could see the Texan flying very scale-like on a well-broken-in Saito .56—a very powerful engine for its size. Of course, any strong .46 to .48 2-stroke would also be a perfect match.

• LANDING AND TAKEOFF

Considering the size and shape of the Texan's wing and airfoil, its slow and relaxing flight characteristics really weren't surprising. On the final, the Texan has a solid sport-plane feel. Even with the cowl stuffed with the Surpass .70, giving a slightly nose-heavy balance point, the model would slow up beautifully for main-gear landings. You don't have to grease this one in. With a lighter motor, a slightly lower wing loading and a dead-on balance point, I'm certain the Texan would make picture-perfect 3-point landings every time.

For takeoffs on grass, the supplied wheels might give you a problem depending on how well groomed your field is. The wheel wells can accept slightly larger wheels, but wheel and wheel-well alignment have to be maintained perfectly for complete retraction. With its short main-gear struts and healthy tail moment, the Texan doesn't need as much up-elevator on rollout as some other designs with taller gears and shorter tail moments require. You do need to hold full up-elevator for taxiing, and some for takeoff rollout, but it can be neutralized quickly as speed picks up. Also, owing to the long tail moment, not a whole lot of right rudder is needed to keep things straight on takeoff. If you fly off a grass field that's a bit rough, you might consider building your Texan with a fixed gear. You'd have yourself a BT-14 Yale!

Medium CA works well here. Epoxy four hardwood blocks to the fuselage's front ring, and mount the cowl on the blocks.

RADIO INSTALLATION

Mount throttle, rudder and elevator servos in the fuselage. The elevator servo drives two pushrods—one for each elevator—and the instruction manual shows a simple way to do this. The receiver and battery pack are just forward of the servos. I added a Great Planes switch mount and charge jack (GPMM1000).

The wing contains two or three servos, depending on whether you use the optional retracts, and Great Planes has provided all the hardware for the radio installation, as well as pushrods, clevises and control horns. The most important part of the aileron servo installation is to ensure a good glue bond on the blocks that are mounted to the servo hatch covers. The pull-strings for the aileron-servo extension wires really help with this step.

All the control surfaces use CA hinges, and you need to be careful with them. Great Planes recommends that you have 1/64 inch of clearance between the trailing surface and the control surface. This allows the proper movement without binding at the hinge joint.

FINISHING

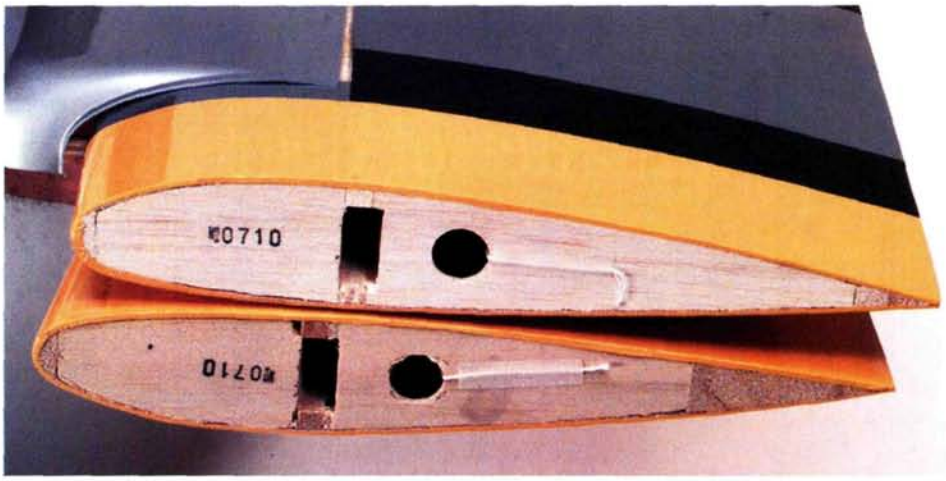
The Great Planes AT-6 kit comes with ABS wingtips that are attached using medium CA. Check the clearance for the aileron tip before final gluing; some trimming may be required. Not so for the cockpit; it's a perfect fit. Use a few small screws to fasten it securely, or you can glue it if you prefer a permanent installation.

The generous supply of decals included in the kit adds the final touch to your AT-6. Once decorated to your satisfaction and with all of the equipment installed, including the prop and battery, it's time to balance the Texan. My Hobbico CG machine makes this final step a breeze.

CONCLUSION

The Great Planes AT-6 Texan is a perfect example of what makes ARFs so popular these days. The scale details are impressive, the construction quality is excellent, the assembly is fast and trouble-free, and the flight characteristics are on a par with many sport planes. The Texan is a highly admired, classic warbird; the Great Planes .40-size rendition is destined to develop just as favorable a reputation among modelers.

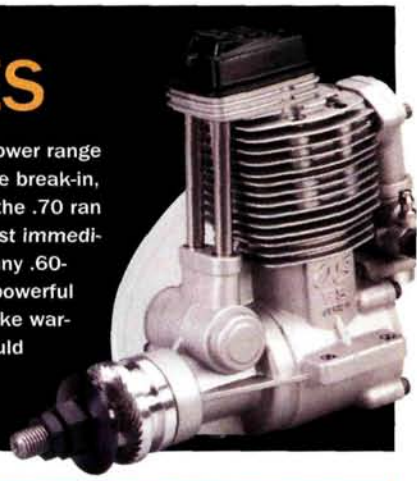
**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.* +



Wing root ribs have aileron pull-through strings taped to them, ready for use—very convenient.

POWER CHOICES

The O.S. .70 Surpass is at the top of the suggested power range for the Texan. Swinging an APC 13x6 prop, after some break-in, it flies the model with authority. In classic O.S. style, the .70 ran virtually right out of the box, idling at 2,500rpm almost immediately. The Texan would be adaquately powered with any .60-size 4-stroke, and even a broken-in Saito .56, a very powerful engine for its size, would be a good choice for scale-like warbird flight. Of course, any .40- to .50-size 2-stroke would also do the job for this model.



FLIGHT PACK

Hobbico's Command servos were used throughout the Texan, and they seemed to have quality on a par with other name-brand radio equipment, at a very good price. Two CS-59 low-profile ball-bearing aileron servos (with a transit speed of 0.10 sec. and 61.1 oz.-in. of torque at 4.8 volts) were used for roll control; three CS-55 deluxe standard servos were used for rudder, elevator and throttle. A CS-63 low-profile ball-bearing retract servo (not shown) was used for the gear. Hobbico's Command CR-7 dual-conversion 7-channel FM receiver was also used. All Command equipment functioned perfectly during the flight testing, photo sessions and subsequent flights with the Texan.

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

Classic ARF barnstormer

DYMOND

de Havilland Tiger Moth

by Bob Van Tassel

The de Havilland Tiger Moth biplane is one of the most versatile and beloved light aircraft in history. That a model manufacturer would release an ARF version of this plane was inevitable, but it would take a special model to do justice to the Tiger Moth's superb design and impressive reputation. Dymond* has pulled it off nicely with its 52-inch Tiger Moth ARF. Since first being flown in 1931, Tiger Moths have been used for everything from military trainers to some of the very first crop-dusters. The swept and staggered wings gave the biplane unprecedented performance and utility and a distinctive appearance that is captured beautifully in Dymond's sport-scale ARF.

I was impressed from the start with the superior quality of the parts and the excellent covering job—no sags or wrinkles. The construction is balsa and ply, and the cowl is fiberglass. The engine mount comes installed in the epoxy-coated engine compartment, and the servo-extension leads are built into the wings. The aluminum wing struts and steel landing gear have a powder-coated, baked-on, mar-resistant finish. The kit does not come with decals, and I also would like to have seen windshields included. I found the instructions a bit sparse; only two written pages without diagrams.

SPECIFICATIONS

Type: sport-scale ARF

Manufacturer: Dymond

Wingspan: 52 in.

Weight: 5 lb., 10 oz.

Wing area: 900 sq. in.

Engine req'd: .46 to .61 2-stroke or .52 to .61 4-stroke

Engine used: O.S. .52 4-stroke

Prop used: 11x 6

Radio req'd: 4-channel w/5 servos (motor, elevator, 2 ailerons, rudder)

Radio used: Futaba* T6XA

Price: $189.99

Features: high-quality construction throughout. Includes complete hardware package, one-piece landing gear, molded fiberglass cowl, pre-installed aileron servo cables and pushrods, prehinged control surfaces and fuelproofed engine compartment.

Comments: fast-building, good flying sport-scale model of a popular airplane that will satisfy the craving of modelers who like biplanes.

HITS • Fast assembly. • Good flight performance. • Good-quality construction and parts. • Nice covering.

MISSES • Thin, unillustrated instruction manual. • No decals or windshields.

The Tiger Moth really draws attention at the field. The distinctive sweep and stagger of the wings give this plane a nice scale look.

The engine bay comes fuelproofed and has pre-installed hardwood rails. The rails have down- and side-thrust built in to make engine installation simpler.

The O.S. .52 4-stroke is plenty strong, but it isn't going to power the Tiger Moth to any speed records.It produces scale flight at ¾ throttle and provides enough thrust for scale acrobatics.

The kit looks great right out of the box. The black and yellow covering is particularly nice—no sags or wrinkles.

ENGINE AND FUSELAGE

I started by installing my O.S.* 52 4-stroke engine in an inverted position on the pre-installed, fuelproofed hardwood rails. The firewall is made of sturdy plywood and is also fuelproofed. The appropriate amount of down- and side-thrust is built into the engine rails. Be careful not to scrape off the fuelproofing when you install the engine. Next, trial-fit the cowl and cut the necessary access holes (in addition to holes for the needle valve, muffler and fuel filler, I cut a hole in the bottom for access to the plug). I also opened the indented air intake in the front of the cowl. Like the full-size plane, the model has a radiator opening on only one side. I was somewhat concerned that this wouldn't provide enough ventilation, but the cowl bulges at the rear and doesn't fit tightly against the fuselage, so air exits easily. This allows enough airflow over the engine to keep it cool.

FLIGHT PERFORMANCE

I ran a tank of fuel through my O.S. .52 4-stroke to break it in and to check for overheating, since the cowl opening is rather small. The ventilation was sufficient, so I taxied the Tiger Moth out onto the grass field and pointed it into the breeze.

• TAKEOFF AND LANDING

The Tiger Moth lifts off gently in about 75 feet at ¾ throttle and some right rudder. My plane required just a little trim correction to fly straight and level. Next, I decided to test its stall tendencies, and I was pleased to discover that it takes some work to get the de Havilland to stall. With full up-elevator reducing forward speed to a crawl, the Moth finally stalled, dropping the left wing. It then recovered some speed and was flying again almost immediately. Very forgiving! Landing was just a matter of reducing the throttle, lining up with the runway and settling in on the mains. The oversize tailwheel comes in handy on grass fields.

• LOW-SPEED PERFORMANCE

The Tiger Moth excels at slow speeds—exactly what you'd expect of a 1930s biplane. It's right at home cruising leisurely over the countryside. The rudder size gives it positive control at slow speeds, and its stall resistance makes for worry-free flying.

• HIGH-SPEED PERFORMANCE

This isn't a high-speed plane, as is obvious from the design. Two wings and flying wires produce a lot of drag, limiting top speed. With the right powerplant, however, the Tiger Moth will fly reasonably fast.

• AEROBATICS

Is this a pattern plane? No. Does it perform aerobatics? Yes! And it performs them well. The Tiger Moth flies at scale-like speeds at ¾ throttle and performs every maneuver that its full-size counterpart does. Inverted flight requires some down-elevator. With ailerons set at the low rate, rolls required some correction. At high rate, the rolls were more axial. Loops were impressive, and with the elevator set at high rate, the model almost looped on itself. Spins? No problem! Take a look at the size of the rudder, and compare it with the fin. The rudder takes a little getting used to; it has a lot of authority. But once you have a feel for it, this surely is a fun Sunday flyer.

The inside of the radio box is roomy, and access is easy through the removable cockpit. When the two screws are removed, the cockpit slides sideways like a desk drawer, revealing the opening beneath.

I drilled four holes to mount the cowl and inserted a small piece of fuel tubing in each hole to accept the cowl screws; this minimizes cowl splintering. I used three lines on the supplied fuel tank. I ran the filler line to the cowl's side and inserted a black plug button on the fuel filler line; it's almost invisible. The fiberglass's high quality is particularly apparent during these steps.

Access to the inside of the fuselage is through the cockpit area, and the cockpit is held in place by two screws. When the screws are removed, the cockpit slides out sideways like a drawer opens. I used black fuelproof paint to finish the cockpit's interior. The pushrods are already installed, so all you have to do is assign the proper pushrod to the elevator and rudder. There is plenty of room inside for the RC gear. I installed two hardwood rails across the fuselage and soft-mounted my receiver on them. I installed a flat battery pack under the fuel tank and then mounted a switch with a charging jack on the side of the fuselage.

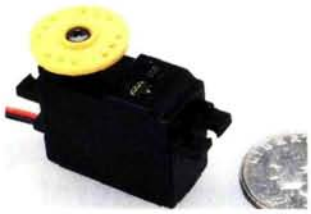
Flying wires made from beaded elastic cord added an extra scale look. Hooks and eyes glued to the struts hold them securely.

WINGS AND TAIL FEATHERS

The ailerons are pre-hinged and use covering material to form the hinges. The instructions recommend using a heat gun if the hinges are tight, but mine were perfect and required no adjustment. The plastic angle strut joiners fit into slots in the wing and are held in place with self-tapping screws. I used microservos for the ailerons and adjusted them before I installed them permanently in the aileron wing pockets. I set the output horns on the servos so that I had more up differential than down. The aileron servo cables are pre-installed, and I used the kit's provided Y connector on the two cables (the plane has ailerons on the lower wing only). The lower wing goes on first, followed by the inter-plane struts. The shorter struts go to the leading edge of the wing; the longer ones go to the rear. The Z-shaped cabane struts are attached during the final assembly, and this automatically sets the incidence. This procedure is time-consuming, so it's better suited for the shop than for the field.

Far left: the pushrods for the tail's control surfaces are already installed. The rudder pushrod also actuates the steerable tailwheel. Left: Dymond has threaded the servo leads in the wings for you—a nice touch. All you have to do is drop in the microservo and attach the leads.

Remove the covering on the fin and stabilizer where they join the fuselage, and epoxy them securely. Insert the tailwheel tiller arm into a hole in the rudder, and slide the nylon steering bushing into the slot in the fuselage. Attach the control horns and clevises, being careful not to break the pre-installed pushrods in the fuselage.



The aileron wing pockets are too small for standard servos, so microservos must be used. Standard servos fit fine for the rest of the plane.

FINAL ASSEMBLY

I reversed the landing-gear assembly as the instructions recommend. This isn't scale, but it puts the wheels farther forward and improves ground handling. I installed the main wheels and the tailwheels and applied the instrument panel stickers, all of which were supplied with the kit. I felt that the plane needed a little more detail, so I added flying wires. A few dressmaker's hooks and eyes from my wife's sewing basket worked nicely. I attached the hooks to the struts with CA and attached the eyes to pieces of black elastic beading cord. I deliberately cut the elastic a little short and then stretched it to simulate the flying wires. Using the same method, I also attached two simulated rudder cables.

The built-up tail structure is light and strong. The covering material also serves as the hinges.

The kit did not come with any windshields, so I cut mine out of scrap plastic. I painted a black frame around the "windscreens" (in deference to the de Havilland's British heritage) to give them a more scale look. The Tiger Moth insignias are based on the emblem used by the Tiger Moth Club. I simulated these with some tiger and butterfly stickers that I purchased at a crafts store. I covered the wing's top center section with black and yellow checkerboard trim; this is the fuel tank location on the full-size plane. I simulated the ID number with stick-on lettering from an office supply store.

I double-checked everything before final assembly; this isn't a plane that can be quickly assembled at the field. This doesn't present a problem because it is easily transportable when fully assembled. I added a 1½-ounce Prather* nose weight to set the CG 120mm back from the top wing's center section.

CONCLUSION

Assembly was pretty straightforward, and anyone with ARF experience shouldn't have a problem. All parts fit well; this is a well-engineered, well-thought-out kit. I thoroughly enjoyed assembling the Tiger Moth, and the final product is wonderful at the field; it really turns heads and is great fun to fly. It's relaxing to cruise, but exciting performance is available on demand. Nice going, Dymond!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.* ✦

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

MRC/ALTECH

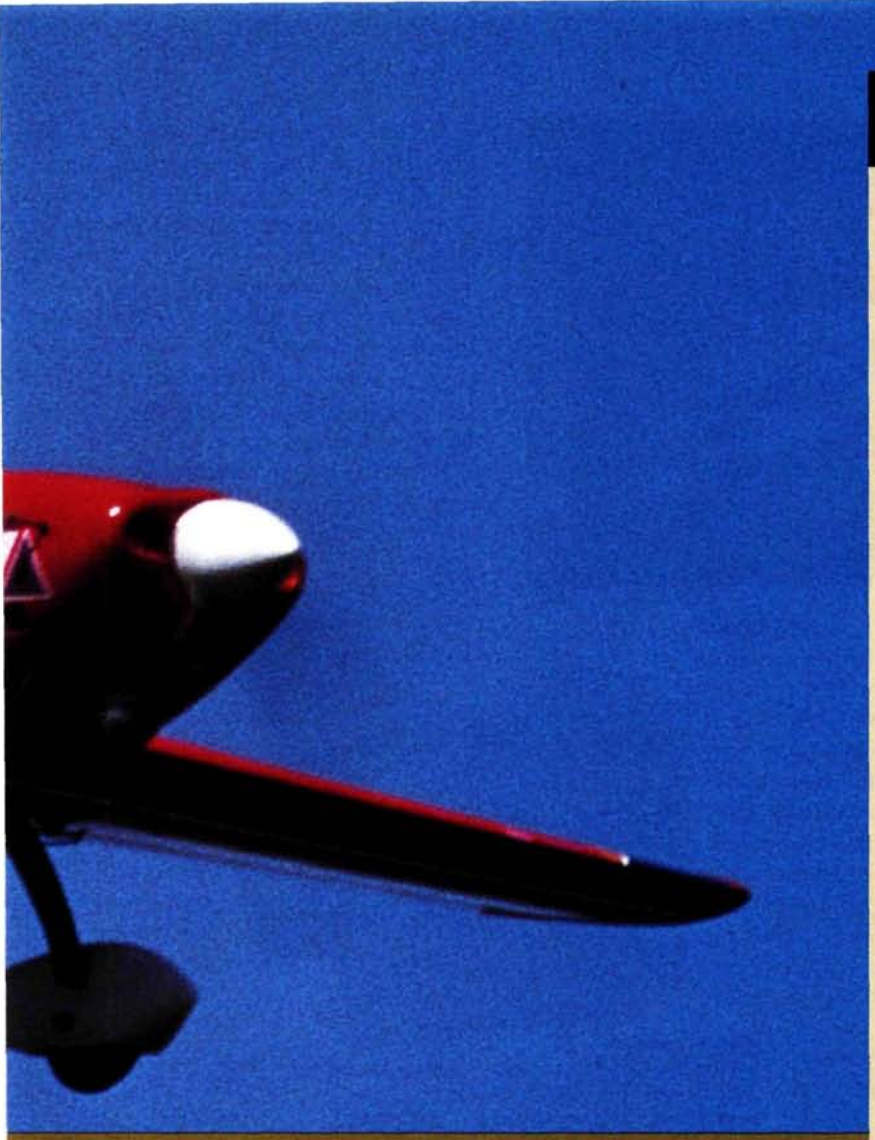
EZ EXTRA 330L ARF

Quick-to-build aerobat

by Jim Onorato

Building and flying beautiful, aerobatic scale ARFs is "EZ" once again, thanks to Altech Marketing*, and the Extra 330L is the ideal plane to celebrate the return. After the EZ line of ARFs from OK Model Co. disappeared from the U.S. market in the early '90s, many modelers feared they'd be permanently without these great-looking, great flying aircraft. This would have been a shame because the EZs had developed a favorable reputation for their excellent flight characteristics and for their unique laminated skins. These skins have a plastic foam base, a layer of paper graphics and a clear Mylar covering to protect the surface; this results in a high-quality finish while remaining very light. The Extra 330L benefits from all the characteristics that made the rest of the EZ line so popular the first time around, and with Altech's backing, it and the other EZs should enjoy even more success from now on.

The EZ Extra 330L kit is very complete and benefits from OK Models' innovative covering process. The result is a light, sturdy construction and a smooth, tight (and colorful) finish.



SPECIFICATIONS

Manufacturer: OK Model Co. Ltd.

Distributor: Altech Marketing

Type: Aerobatic sport scale ARF

Wingspan: 50.4 in.

Wing area: 513 sq. in.

Weight: 5 lb., 12 oz.

Wing loading: 25.8 oz./sq. ft.

Length: 48.8 in.

Radio req'd: 4-channel w/five servos

Engine req'd: 0.45 2-stroke, 0.70 4-stroke

Engine used: Enya 50CX 2-stroke

Street price: $300

Features: 90-percent complete ARF; patented triple layer outer skin over inner wood frame; plastic cowl and wheel pants; carbon-fiber landing gear; clear, molded canopy; hardware; spinner; fuel tank; wheels and pilot figure.

Comments: the finish on the EZ Extra is fantastic, thanks to the 3-layer laminated skin. Its light weight translates into sharp, responsive flight characteristics. The kit is very complete and easy to assemble, and it makes aerobatic performance available with a short building time.

HITS

- Excellent flight performance.
- Good parts fit.
- Ease of assembly.
- Completeness of kit.

MISSES

- Weak landing gear (see text).
- Poor-quality plastic clevises.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

I started with the recommended throws for high rate and set the low rates at 60 percent. I applied some up-elevator to keep the tail down while I slowly advanced the throttle, then released it as the plane gained speed. The plane tracks nicely with just a slight tendency to turn left, but that is easily countered with a little right rudder. When the Extra reaches flying speed, just a touch of up-elevator lifts it smoothly into the air. Aileron trim corrected a slight roll to the right, and a bit of down-trim gets the Extra flying straight and level.

The Extra has a surprisingly shallow glide slope that made landings a real pleasure. I set up a long approach and throttled down to establish the rate of descent while using a slight amount of up-elevator to bleed off some airspeed. This plane takes quite a while to slow down; I used the full length of our field before touching down.

• LOW-SPEED PERFORMANCE

The Extra handles very well at all speeds. When I tried to force a stall at a safe altitude, the tail dropped slightly and the plane just continued to fly. When it finally stalls, it is gentle and straight-ahead.

• HIGH-SPEED PERFORMANCE

The Extra flies very well at full throttle and is very responsive to control inputs—especially aileron. I reduced the low rate aileron throw and increased the exponential from the initial recommended settings, and that really smoothed things out. Other than the sensitive ailerons, I did not experience any bad tendencies at high speed. The Enya 50CX provided more than enough power for the Extra.

• AEROBATICS

The Extra was designed for aerobatics. I couldn't wait to see what it could do, and I was not disappointed! It performs high-speed loops without rolling out or losing heading, and its high-speed rolls are perfectly axial. With aileron throw at high rate, the rolls were so quick that I wouldn't have had time for elevator correction even if it was needed. Four-point rolls and snap rolls are very crisp. Inverted flight requires just a hint of down-elevator to maintain altitude. Sustained knife-edge is a breeze, as are outside knife-edge circles. Spins are fine (once I got it to stall), and recovery is immediate. Overall, the Extra 330L has excellent flight characteristics and makes aerobatic flying "EZ"!

THE KIT

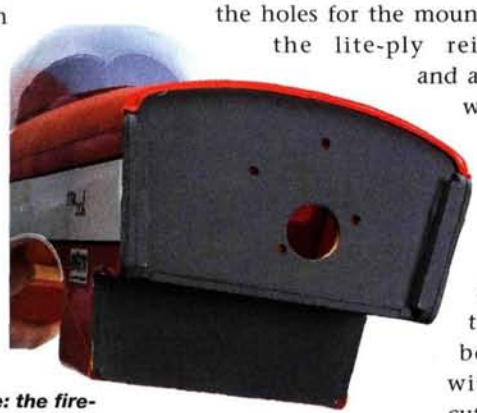
I hesitate to use the word "kit" for this very complete ARF. This plane is 90-percent complete and includes everything you need to get flying except radio, engine, fuel tubing and propeller. Even a pilot figure is included! The graphics are typical of the EZ line; they are bright and colorful, albeit a bit unusual. The graphic on the underside of the wing and stab is a beach scene complete with a bikini-clad bather, a sailboat, a helicopter and a seagull. Not exactly what you expect to see on an airplane, but the mostly blue underside provides a good contrast with the red upper surfaces. Control horns, clevises and other plastic parts are all found on a molded tree along with some extra parts that I didn't use. The ailerons are already hinged, and with almost no gap. A fuel tank, carbon-fiber landing gear, plastic cowl, wheel pants, wheels, engine mount, spinner, pushrods, molded canopy, pilot and a complete hardware package (with metric nuts and bolts) are all included. A 23-page instruction booklet filled with excellent photo illustrations guides you through assembly without the need for full-size plans.

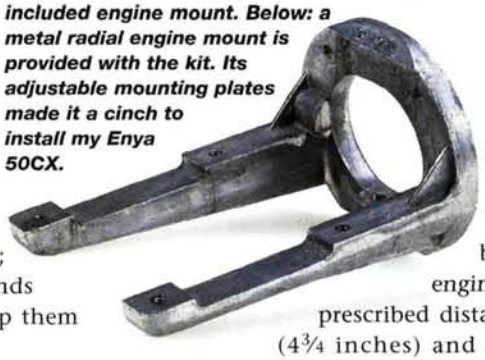
ASSEMBLY

The Extra wing comes in two halves and requires two servos for the ailerons. I mounted the servos in the servo wells and affixed the plastic covers with double-sided tape. I used the provided hardware to attach the aileron control horns to the ailerons. The aileron pushrods are made of 1.8mm music wire, threaded on one end. A Z-bend is used at the servo end. I did not use the plastic clevises supplied with the kit because they were rather flimsy and wouldn't close; however, nylon bands are provided to keep them closed.

I joined the wing halves using 30-minute epoxy on the center ribs and the lite-ply wing joiner. The lite-ply center ribs have a tab on them that locks the leading edge of the wing in the fuse. The wing joiner fit snugly into the wing-joiner pockets. The instructions call for 7mm dihedral at each tip, but I just made sure the root ribs were glued tightly together without gaps and let the dihedral angle be whatever it came out. It looked pretty close to 7mm when the epoxy cured. I taped the plastic top center wing cover into place and glued it with thin CA at the edges. Be very careful when you use CA on this model—it will dissolve the foam on the exposed edges.

The wing-bolt mounting plate is made from three die-cut pieces of lite-ply that I laminated using medium CA. I installed blind nuts and epoxied the block in the fuselage. After making sure the wing was perfectly aligned to the fuse, I drilled out the holes for the mounting bolts, added the lite-ply reinforcing plate and attached the wing with two 4mm steel bolts. The joint between the wing saddle and the wing was perfect! I then glued the plastic wing bottom cover on with thin CA and cut holes for access to the wing-mounting bolts.

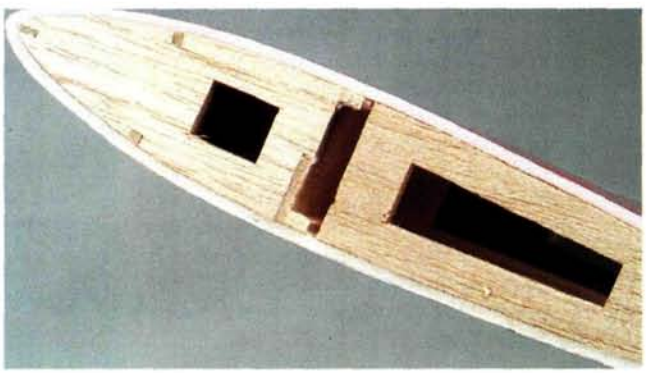


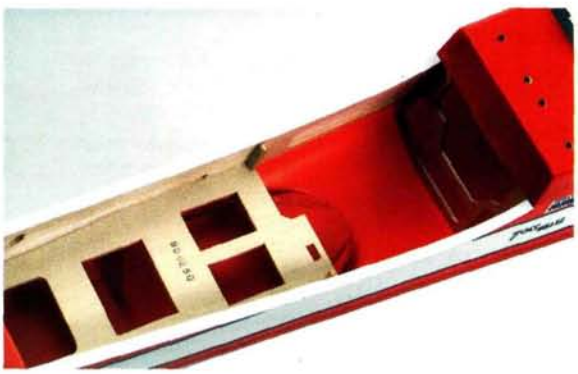


Above: the firewall is fuelproofed and predrilled to accept the included engine mount. Below: a metal radial engine mount is provided with the kit. Its adjustable mounting plates made it a cinch to install my Enya 50CX.

The radial engine mount is metal and has adjustable plates. I attached it to the firewall with 3mm bolts into blind nuts. I placed the engine on the mount at the prescribed distance from the firewall (4¾ inches) and drilled the plates to match the Enya 50CX engine. I mounted the engine with the head at roughly the 8 o'clock position so the muffler lined up with the bottom centerline of the fuse.

I assembled and installed the fuel tank and fittings next. The tank fit nicely in





Left: note the laminated foam construction that made the EZ line so well regarded. It's light, strong and looks great! Right: the fuselage has plenty of room for the radio gear and fuel tank. Thanks to the pre-installed servo tray, everything is easily accessible.

the fuse former with the pick-up and vent tubes protruding through the firewall. I installed a Sullivan* fueler in the left side of the cowl.

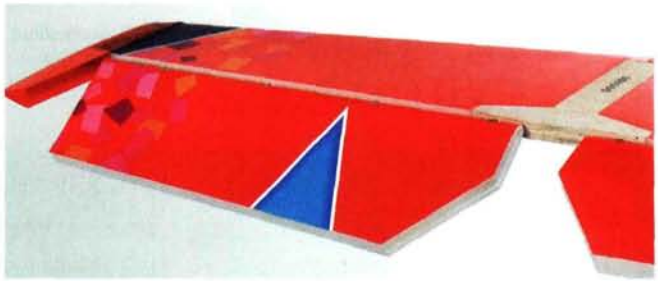
I mounted three standard servos in the factory-installed servo tray and made up the rudder and elevator linkage rods per the instructions. All the necessary hardware is included, but I did not use the clevises or the round balsa pushrods from the kit. I replaced the pushrods with hardwood dowels. The elevator pushrod has two threaded wires on the control surface end—one for each elevator half. The wire on the servo end is unthreaded. I used L-bends with snapper-keepers at the servo ends rather than making the Z-bends called for in the instructions. The throttle pushrod is a solid wire in a plastic tube.

The white plastic wheel pants provided are attached to the landing gear in a unique fashion. There is a slot high on the inside face of the wheel pant into which the landing gear is inserted so that the joint between the axle and the landing-gear strut is inside the wheel pant. A 4x40mm bolt is used for the axle. I don't particularly like this arrangement because it does not allow the wheel pant to rotate if it's bumped during a landing. I like to mount wheel pants with fittings that have enough tension to keep the pants straight under normal conditions but allow them to rotate when stressed to prevent breakage.

The landing gear is carbon fiber and comes in two halves that are attached to the fuse with two 4mm steel screws. They are quite strong vertically but not as strong laterally. Mine cracked on a dead-stick landing in the rough. Altech replaced the gear immediately, and the replacement pair has been fine thus far. Maybe I just got a bad set with the kit.

I attached the tailwheel assembly to the fuse with two screws. I removed the covering on the elevators and rudder and placed die-cut lite-ply pieces where the control horns attach. I then applied stickers that matched the covering over the lite-ply. Hinge points are already installed and glued in one surface of both the elevator and rudder. I used epoxy to attach the elevator hinge points to the stab after applying Vaseline on the pins to prevent the epoxy from sticking to them. Next, I epoxied the fin to the stab using the plastic root cover as a jig to position the fin properly. Then I glued both to the fuse and attached the rudder.

I attached the cowl to the firewall with four metal angle brackets and four sheet-metal screws. A decal is included for the front of the cowl, but it closes off the front and leaves no opening for ventilation. I opened up the area on each side of the spinner for cooling and did not use the decal.



The elevator and rudder come with hinge points already installed. All that's left is to epoxy them into the stab and fin.

The final steps were to apply the decals and to install the canopy and pilot figure. The pilot is made of thin plastic, and it was a bit difficult to get his head together. However, when painted, he looked pretty cool with his shades and '50s-style hairdo.

CONCLUSION

I found the Extra 330L to be a well-made ARF that went together easily and looked neat when assembled. I chose to replace a few minor pieces, but the completeness of the kit made this a luxury rather than a necessity. If you want a plane that gets into the air quickly, burns up the sky with wild aerobatics and looks great doing it, then OK Model Co.'s EZ Extra 330L will satisfy you on all counts.

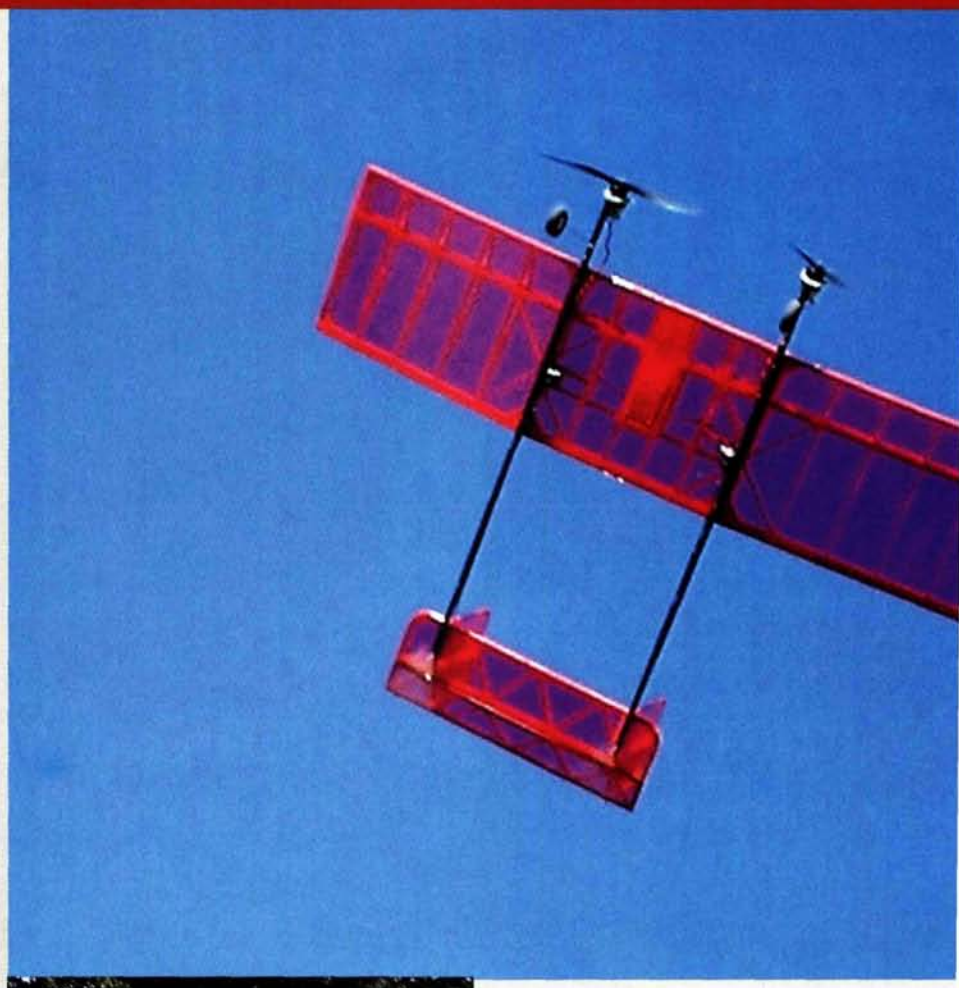
**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.* ✚

NORTHEAST SAILPLANE PRODUCTS

Pleaser

Versatile twin backyard flyer

by Darren Bos



Few things beat a relaxing cruise around the park at sunset. But what if you want to tear things up a little? Well, Northeast Sailplane Product's* Pleaser 2 does both. The Pleaser 2's large range of possible battery configurations gives it amazing flexibility. The cool look of a twin and the transparent covering are also great.

CONSTRUCTION

The plane comes highly prefabricated, and it's easy to finish in a few leisurely evenings. The instructions are clear and easy to follow, although the lack of photographs might require a novice to take more time to figure things out. All of the parts in my kit were true and fit together well. I chose to go with removable outboard wing sections, so I taped rather than glued the outer panels into place. This makes the Pleaser 2 much easier to store and transport.

The only parts of the instructions I found ambiguous—even absent—were the descriptions of how to mount the servos and set up the control throws. I used a red-hot pin to melt a hole of the appropriate size under the wing and then used Goop glue to mount the servo. Melting rather than cutting the covering material helps prevent nicks and cuts that could cause it to tear. Control throws ¾ inch from center for the elevator and rudder work very well and help to maintain low-speed control authority. I didn't like the heavy wire that was supplied for the motor connections. It weighs 17.3 grams; an equivalent length of 20-gauge wire weighs 9.6 grams. The difference (7.7 grams) is half the

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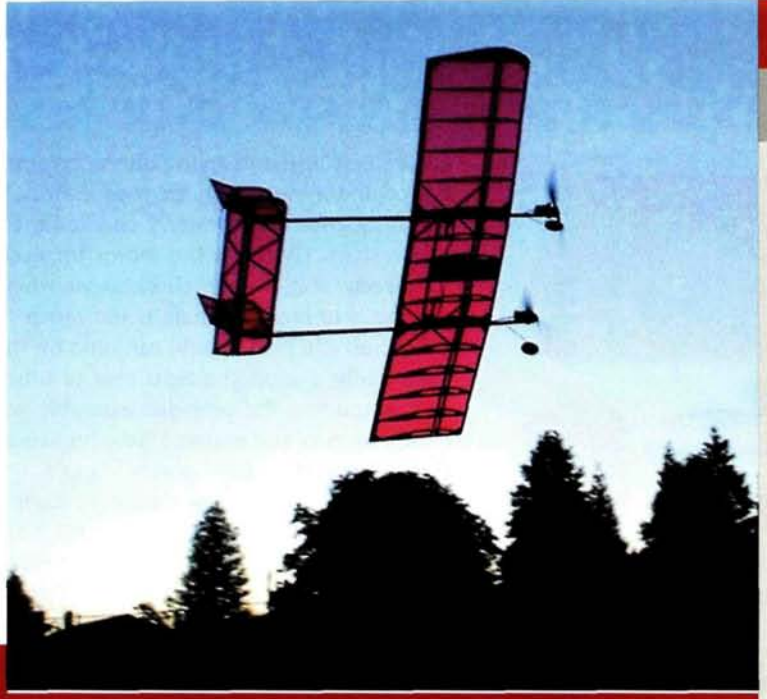


SPECIFICATIONS

Model: Pleaser 2

Distributor: Northeast Sailplane Products

Type: ARF park flyer/slow flyer

Wingspan: 42 in.

Airfoil: flat-bottom

Washout: ¼ in.

Wing area: 400 sq. in.

Weight: 15 oz.

Wing loading: 6.5 oz./sq. ft.

Length: 32 in.

Motors supplied: Graupner Speed 280s w/4:1 gear reduction

Props supplied: 9x7

Speed control used: Castle Creations* Pixie 14

Radio req'd: 3-channel (motor ESC, rudder, elevator)

Radio used: Hitec* Prism w/Spectra Synthesizer, Micro 555 RX, HS55 servos (two)

Price: $129.95

Comments: this is a versatile plane that can use a variety of battery-pack configurations to offer plenty of power yet maintain relaxing, slow-flight performance.

weight of my receiver! My replacement 20-gauge wire was heavy enough; with 4 feet of wire (positive and negative wires combined), there's less than a 0.25V loss. A handy table to help you to figure this out is at http://members.xoom.com/morrisos1/monketronics007.htm.

The Pleaser 2 wheels are nice, light foam, but the hubs are bored slightly larger than the supplied piano-wire landing gear, so the outer part of the wheel may rub against the wire. To solve this problem, you can mount a 0.72-inch piece of 3/32 aluminum tube to the axle and use a couple of pieces of soda straw for wheel collars. This modification helps the Pleaser 2 to get off the ground more quickly.

Fitting the electronics and a 650mAh NiMH battery pack into the wing's center section is fairly easy; with the 600mAh Ni-Cd pack, you really have to work. Although I managed to fit the Ni-Cd pack, the CG was slightly far back (a bit more than ½ inch behind the spar). The plane is still controllable, but it is a little twitchy. If you go for the larger pack, I recommend that you mount the battery outside and underneath the wing with hook-and-loop fastener. This will make it much easier to set the CG correctly and to fit everything inside.

BREAKING IN THE MOTORS

One really important step is to properly prepare the motor gear drives. These little Speed 280 units are very convenient and inexpensive, but they require preparation and maintenance to work properly. First, I disassembled the entire unit and pulled the motors out of the back of the gearboxes. Mine were really jammed in there, so I removed the C-clip from the propeller's front, removed the propeller assembly and then, holding the outer plastic casing, pushed the pinion gear against the edge of my desk. Then I started the water break-in of the motors. Seating the brushes lowers the resistance between the brushes and the commutator and helps keep things

FLIGHT PERFORMANCE

I had a lot of fun flying the Pleaser 2 in a small field just around the corner from my place. The dirt base lines of the baseball diamond, although rough and very uneven, worked great as runways. The Pleaser 2 lifted off in about 20 feet without difficulty. I'm sure that off an even surface, this distance would be much shorter. The plane is extremely stable; despite my best attempts to roll it, it resists axial rolls. It loops its little heart out, however. The plane tracks so well that you just open the throttle, pull back on the elevator and watch it go around and around. After a little practice, I was very comfortable looping it 6 feet off the ground right in front of me!

I really like to shoot touch-and-go's, and the Pleaser 2 is perfect for this. Just line up the plane, let up on the throttle and watch the plane settle in. As a bonus, the Pleaser 2 has lots of power, so if you mess up your approach, just hit the throttle and go around again. I was amazed at how the Pleaser 2 would just hang on the prop and lumber away as I requested it to do the most absurd climbs and turns at low speed. Stall turns and inverted flight are also good, but be careful with inverted flight: the Pleaser 2 rolls very slowly, so it's better to leave enough altitude to pull out through a half loop (this is only about 5 feet!).

The highly prefabricated Pleaser 2 is quick to assemble, and the transparent covering adds just the right touch as the sun sets behind the plane on an evening sortie.

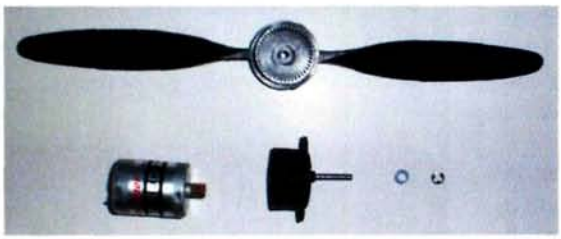
cooler. Less heat and arcing on the commutator mean greater efficiency and a longer life for your motors. While the motors were churning away underwater, I checked the propeller assembly's fit on its shaft. (Without the motor in place, the propeller should spin freely; if it doesn't, check to see whether a plastic flashing is causing it to bind.) If there is too much friction, the plastic propeller hub will heat up and can bind on the shaft. When the prop spun freely, I applied a light coat of lithium grease to the shaft, and remounted the propeller assembly with the washer and the C-clip. Most of the motors I have broken in underwater have usually turned the water gray. These little 280s didn't—probably because they have slightly harder brushes. After an hour of running time—and still no change in the water's color—I took the motors out of the water. I shook out as much water as I could, rinsed them and left them to dry overnight. When they were dry, I relubed the front and rear bushings with light oil.

FINAL THOUGHTS

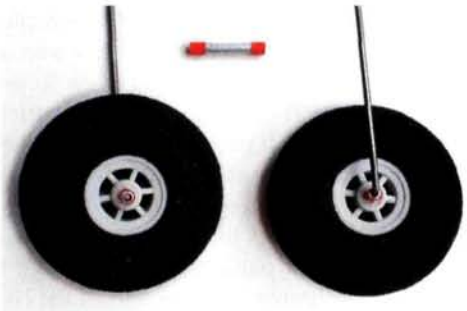
I really like the range of battery configurations I can use with the Pleaser 2—anything from 350mAh Ni-Cds to 1200mAh NiMHs. Both the 650mAh NiMH and 600mAh Ni-Cd packs gave me from 11.5 to 13.5 minutes of flight time with aerobatics and touch-and-go's. The 600mAh Ni-Cds have more punch, but the wing loading is so much lighter with the 650mAh NiMH cells that the plane is almost as aerobatic as it is with the 600mAh Ni-Cd pack. When it's calm, I really enjoy the lower flight speed and tighter maneuvering that the lighter NiMH batteries allow, but if the wind picks up, you definitely want the extra stability and power of the larger batteries.

The Pleaser 2 would make an excellent second RC plane or a nice way to get into slow flight if you already have some Speed 400-size gear. The model has a lot more zip than many of the park flyers out there but still has no bad habits. It's a lot prettier than foam, yet still reasonably rugged.

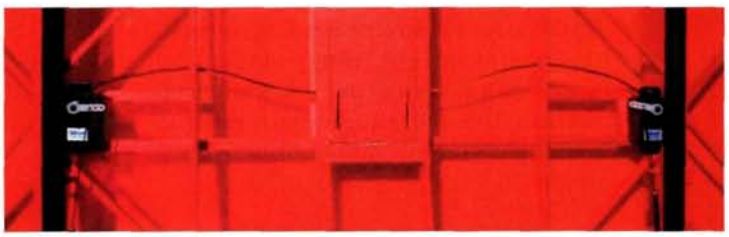
**Addresses are listed alphabetically in Featured Manufacturers" on page 150.* ✦



Taking apart the gear drive and lubricating all the moving parts make a big difference to performance. Before you reinstall the motors, make sure the prop spins freely.



This quick and effective modification to the wheels makes ground handling much better.



Above: using a hot pin, you can neatly cut holes in the covering for the servos. Rather than cut the covering material on top of the wing, I opted for a hatch in the bottom of the wing.

Left: don't worry about putting the motors and wires underwater; at this low voltage, the water is essentially an insulator. Breaking in the motors underwater is faster and helps to wash the dust from the brushes out of the motor.

HITEC PRISM WITH SPECTRA MODULE

Have you ever found a new, lightweight receiver that looks perfect for the project you're working on, only to find out it isn't available for your transmitter frequency? Fortunately, Hitec's nice little piece of equipment—the Prism 7 with the Spectra module—solves this problem. With the Spectra module installed, you get a fully featured computer radio that you can tune to any channel. Just pop the module out, use a small screwdriver to set the two rotary switches, and off you go.

Since I've had the Prism radio, it has largely replaced my other radios. It's just too easy to take a single radio along for the day and not have to worry about which receiver is in my model. As with most other types of equipment, I continue to find new uses for it: my buddy left his transmitter at home; I'll lend him mine. A novice flier at the field wants to try exponential on a computer radio; I'll lend him my transmitter for use with his model.

If you want to upgrade your radio and would like to take advantage of the myriad of new receivers available, the Hitec Prism with the Spectra module is definitely a handy piece of equipment.

A Speed 400, electric sport-scale racer

BUGATTI R-100

by Tom Fey

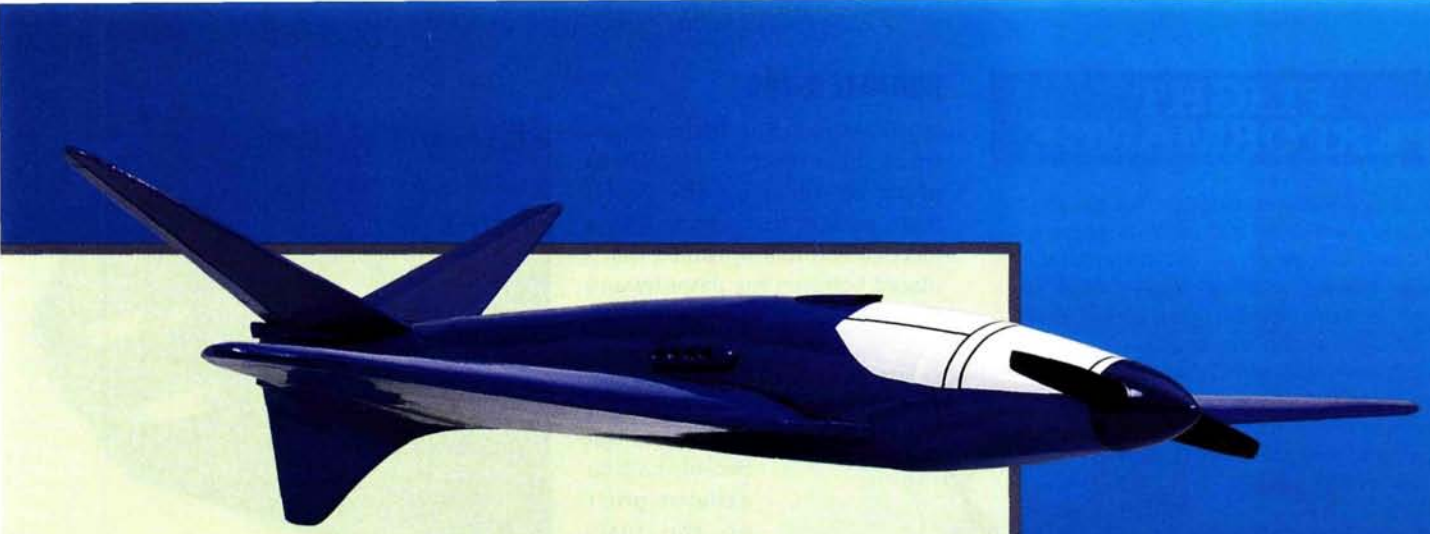
Bugatti is a name firmly associated with pre-WW II cars of exceptional character and engineering, but Ettore Bugatti's firm also built railroad cars and a single airplane, the R-100. Noted Belgian engineer Louis de Monge designed the R-100 in 1938 to challenge aviation speed records, and he chose two 4.9-liter, 475hp, magnesium-block, supercharged, straight-8-cylinder Bugatti engines, then coupled them to contra-rotating propellers to drive the airplane. The pilot was meant to lie almost supine in the nose, a drive shaft under each armpit and fly the craft with the aid of a complicated system of interlinked and automatically operated spoilers, flaps and landing gear. Hidden from the Germans in France through WW II, the all-wood airplane has passed through several owners since then, but thankfully, aviation enthusiasts can enjoy the restored, engineless masterpiece that now hangs in the EAA museum in Oshkosh, WI. This sole Bugatti R-100 never flew!

The forward-swept wing is unusual but it has a typical built-up construction.

I had seen infrequent articles and drawings of this amazing ship (see www.Bugatti.vintageweb.net or *Model Airplane News*, December 1985) and decided that, powered by a Graupner* Speed 400 electric motor, it would be a real showstopper model. My friend and model designer Gus Morfis agreed and drew the plan for this highly unconventional airplane.

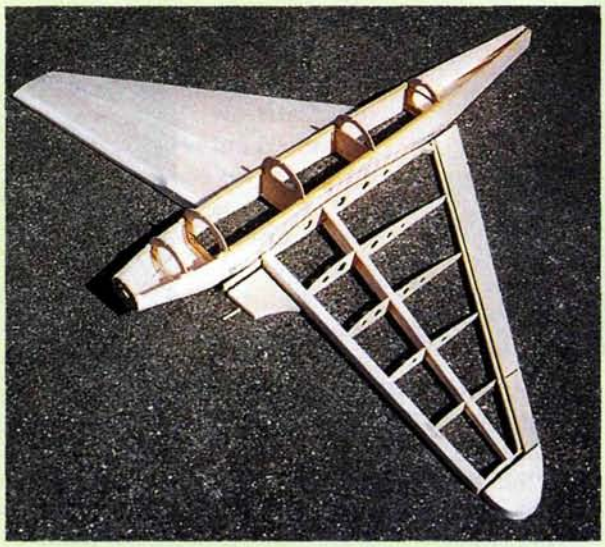
Despite its unusual planform, the model is relatively straightforward to build. Instead of a step-by-step process, I'll comment on some aspects of the construction that might prove helpful to the builder.

Here the completed lower fuselage is shown with the cutout for the wing marked in pen.

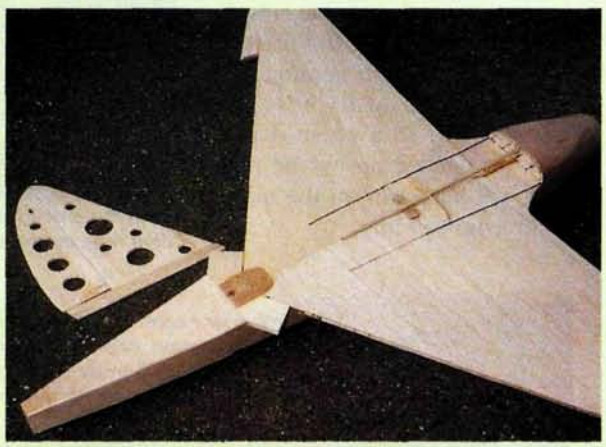


WING

The wing goes together quite simply; however, remember to cant each rib no. 1 inward to provide the required wing dihedral (approximately 9 degrees). I used an oversize piece of 3/8-inch balsa as the leading edge (LE) and allowed the ribs and wing skins to be butt-joined to it. This leaves a square mating surface on the front for attaching the leading-edge extensions (LEX). Don't glue the LEX to the wing until you are ready to fit the wing to the fuselage. The wing trailing edge (TE) is made from 1/4-inch sheet stock and requires considerable sanding to get the proper chord and thickness to blend with the wing.



Above: the general layout of the wing and fuselage shown here before the top sheeting has been applied is very straightforward. The model is easy to construct. Below: the under-wing fairing consists of one balsa longeron, two bulkheads and a single piece of 3/32-inch sheet. Note that the LEX is flush with wing's bottom surface and a 1/64-inch plywood reinforcement plate surrounds the wing's bolt hole.



FUSELAGE

The lower fuselage is built upside-down over the plan; the upper bulkheads are later attached to complete the framework. I left the plywood motor mount in one piece and simply dug a small slit (trough) into my building board to accommodate its height. I skinned the upper fuselage from the motor mount back to bulkhead 4 with two pieces of 1/16-inch sheet. I had to remove a roughly toothpick-size sliver from the center-forward portion of each upper sheet to allow it to follow the compound contour of the forward fuselage. I preformed each sheet by wetting it with water; then I positioned it over the fuselage framework, secured it with rubber bands and allowed it to dry. After a final fit check, I glued each one into place with fast-drying and easy-sanding Pica* Gluit. The rest of the fuselage was sheeted in a similar fashion.

The inner fuselage skin between bulkheads 3 and 4 was strengthened with a glass-cloth lamination using Gluit instead of epoxy. Scrap balsa was placed alongside the dorsal longeron to make a small, flat footing to which I attached hook-and-

Author poses with his Bugatti R-100.

SPECIFICATIONS

Model: Bugatti R-100

Type: electric sport scale

Wingspan: 27.5 in.

Length: 23.75 in.

Wing area: 171 sq. in.

Weight: 16.7 oz.

Wing loading: 14.1 oz./sq. ft.

Power used: 6V Speed 400 motor with a SR* Batteries' 7-cell, 575mAh Max-50 battery pack

Prop: 6x3 Graupner with Carl Goldberg* 1.5-inch-diameter plastic spinner

Radio req'd: 3-channel (aileron, elevator and throttle/speed control)

Comments: the Bugatti R-100 is an all wood ply model with striking looks and good performance. Items used to complete the model included: a Sprite 25 controller from Castle Creations*, two MPI* MX-50 microservos, an Airtronics* 92745 receiver (without case) and a Graupner GR1328 prop adapter.

FLIGHT PERFORMANCE

At Gus's recommendation, for the first flights I adjusted the balance point to 3/16 inch in front of the CG drawn on the plan. The aileron travel was set at ±0.46 inch, and the elevator throw ended up at ±0.7 inch, which seemed like a lot, but I anticipated that the horizontal stabilizers would have a lower effective area owing to the 30-degree dihedral—or so I thought.

• TAKEOFF/LAUNCH

I grasped the Bug underneath the aft fuselage behind the wing and tossed it firmly into an 8- to 10mph breeze from the top of a knoll. The good news is that it took off like a bat with no interference of my launch hand and the ventral fin, and the ailerons were just right. The bad news was that I had trimmed in a little up-elevator, and the nose went uphill in a hurry. The second surprise was the incredible sensitivity to pitch as I pushed the stick to lower the nose. After three wild oscillations, I cut power and landed gently into the wind without a problem. I was both thankful and amazed that the Bugatti seemed impervious to an accelerated stall or spin.

I cut down the elevator throws as much as possible and the elevator area by about 50 percent. A computer radio would have allowed me to dial down the pitch electronically, but lacking this technology, I arrived at the elevator area shown on the plan by trial and error. Elevator travel of ±0.4 inch gives a very responsive but well-behaved pitch control.

• GENERAL CHARACTERISTICS

The forward-swept wing flies as well as or better than a straight wing in that the stall was very predictable, and there was no tendency to spin or drop a wingtip, with excellent aileron response at all times. The wing design really digs in, giving the Bug an incredible rate of turn—and loops with a diameter of about three fuselage lengths! Rolls are moderately fast but not quite axial, and ramming the stick into an upper corner really sends the plane into a tumbling fury. Recovery is instantaneous and without malice; simply neutralize the sticks.

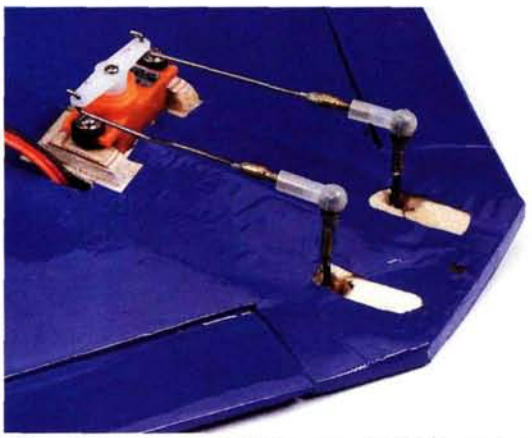
Low-speed flight is very stable, and landing into a 10mph wind will just plop it onto the grass at less than walking speed.

loop fastener. The flight batteries are held firmly but gently in place by securing the 7-cell flight pack to this footing with a piece of stiff foam padding that's placed between the batteries and the wing LEX before the fuselage is closed up for flight.

Just for fun, I drilled the last two of the four exhaust ports on the fuselage's left side clean through the skin to provide at least some airflow to help cool the power system. There is some uncertainty regarding the true shade of the original aircraft ("Bugatti blue" is very light; however, the original plane had a dark blue primer), so for simplicity, I covered the entire airframe with Royal Blue MonoKote*.

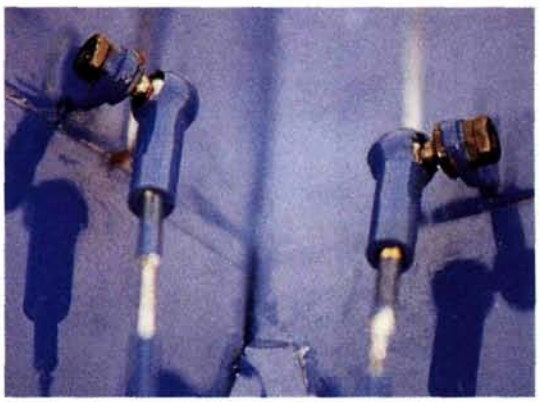
SPINNER

Depending on the spinner and prop adapter you use, you may need to make a 5/32-inch-thick (1/8-inch balsa with 1/32-inch plywood lamination) nose ring to fair the spinner to the fuselage. This model has no landing gear and will land on its nose and ventral fin, so a close-fitting spinner backed up by the nose ring will help prevent the motor shaft from bending.

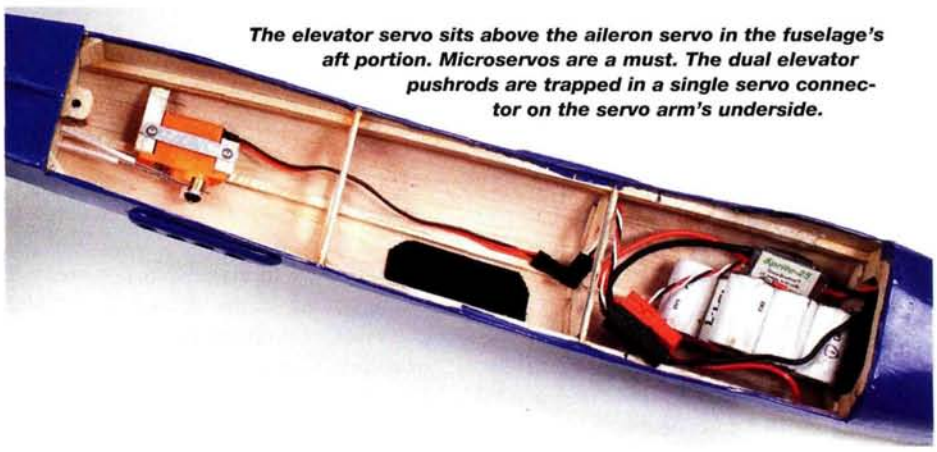


Aileron torque rod installation uses ball-link connectors.

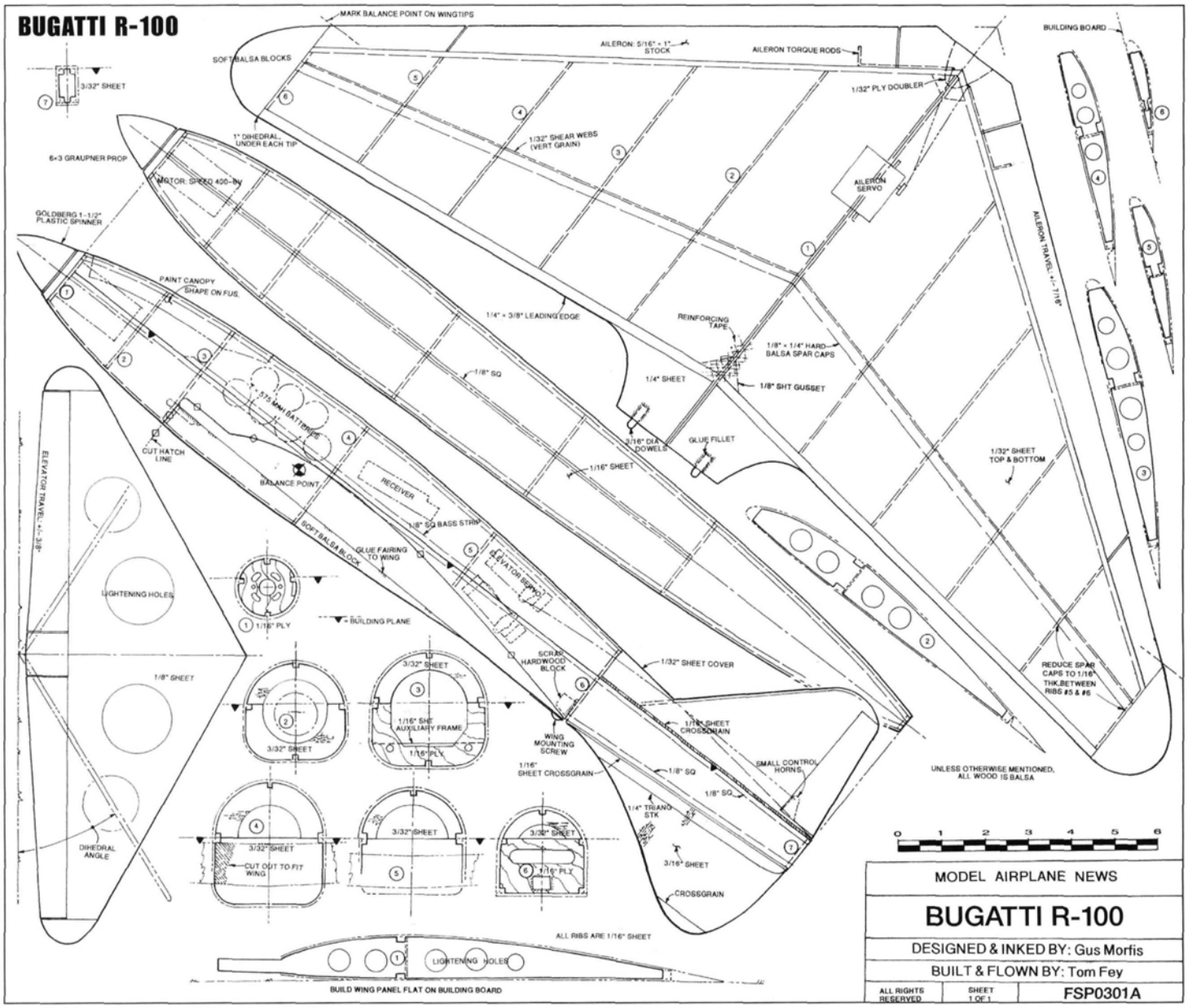
Empennage detail shows the fairing before it had been covered and the stab had been glued along midline.



Dual pushrods simplify elevator-control linkage. Jam nuts on the ball links ensure safety.



The elevator servo sits above the aileron servo in the fuselage's aft portion. Microservos are a must. The dual elevator pushrods are trapped in a single servo connector on the servo arm's underside.



To order the full-size plan, turn to "RC Store" on page 144.

FITTING THE WING

Use a template made from the plan to trace the cutout for the wing onto the fuselage sides, then cut them out using a Moto-Tool. Sand and modify the fuselage cutouts until the wing sits squarely in place. Now is the time to trim and sand the wing LE extensions to make a nice fit against the wing LE, the nose extension of rib 1 and fuselage bulkhead 3. The LEX should be flush with the wing's bottom surface. The holes for the wing-mounting pegs can then be drilled in the LEX, and the ⅛-inch-diameter dowel pegs can be glued into place. A small hardwood block glued to the front face of bulkhead 6 is then drilled and tapped to accept the wing-mounting screw. Once the wing is mounted properly in the fuselage, the LEX and LE can be sanded to the proper shape.

HORIZONTAL STABILIZERS

I glued a piece of triangle stock onto the outside base of each horizontal stab, then I used a 30-60-90 triangle to shim the stab on a tabletop at a 60-degree angle. I then sanded the proper 30-degree angle into the base of the stabilizer using a sanding block that I held vertically against the table's edge. Doing this provided a bigger attachment footprint for the stab to the aft fuselage deck. Use the template noted on the plan to make the aft fuselage fairing from ⅓₂-inch balsa sheet. To form the necessary curvature, wet the balsa and use a rubber band to hold it to a 2-inch-diameter plastic bottle; then cover the fairing with MonoKote. Once the covered horizontal stabs have been epoxied to the fuselage, slide the fairing into place and glue it on. I used individual pushrods (Kavan* no. 0623) and ball links for each elevator and a setscrew-type connector on the elevator servo arm. Both wire pushrods from the elevators fit through the hole in the connector and are trapped by the setscrew.

With all the fuselage curves and unconventional angles, this plane takes a little more work to build and fit than other plan-built aircraft do, and it is not a project for first-time builders or low-time pilots. The very great reward for building the Bugatti is that, despite the original being over 60 years old, the R-100 is a real head-turner in both design and performance. Those modelers who build and fly the R-100 are in the unique position of flying a scale model of an original creation that never had a chance to fly.

** Addresses are listed alphabetically in "Featured Manufacturers" on page 150.*

by Dick van Mourik

Make Molded-Fiberglass Parts

Wheel pants and other formed parts made easy

Mold-making Materials

Mold-release agents—parting wax and PVA (polyvinyl alcohol)
Fiberglass cloth—½- and 1-ounce
Epoxy—aircraft-grade laminating resin
Mold compound—gelcoat and hardener
Resin thickener—chopped glass and cotton fiber
Hobby Poxy* paint—optional

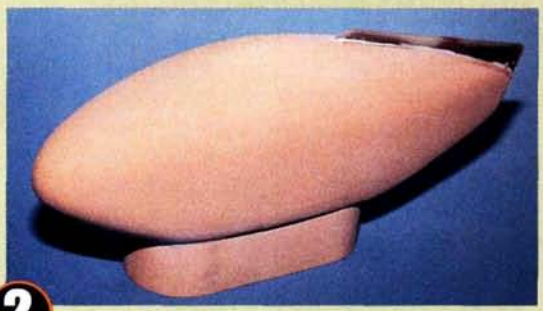
Epoxy resin and mold-making materials can be obtained from: Anchor Seal, K&B Products*, Pacer Technology*, Fiber Glast Development*, Composite Structures Technology (West Systems)*.*

Many modelers reach a point at which they want to do something unique. My particular modeling interest in the Czech-made Zlìn aircraft has led me to design two fully composite, ¼-scale Zlìn Z-50s.

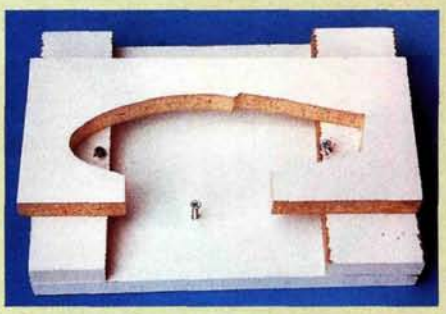
A prominent feature of these aircraft is their streamlined wheel pants, and now you can follow these step-by-step instructions to make your own fiberglass wheel pants. Since a wide variety of other aircraft use molded fiberglass parts, you can apply the same basic process to form other parts; it's amazing what you can make once you know this technique.

THE PLUG

1 Several photos of the full-size wheel pant (at different angles) and a sketch provide the basic information for carving the plug. I used a block of hard polyurethane foam, but pine or bass wood could also be used.

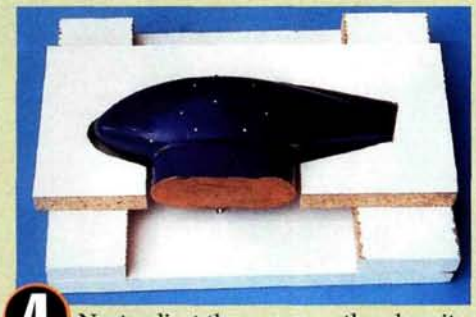


2 Here, the plug for the wheel pants has been carved and sanded smooth. After a final sanding with fine-grit sandpaper, treat it with a grain sealer and spray-paint it for a very smooth finish. The plug needs to be finished to the highest possible level, as any imperfections will show up in the finished part. Careful sanding and polishing at this stage will pay off later.



3 So that you can remove the part from the finished mold, you have to split the mold into two separate pieces (in this case, a left and a right half). You'll need to make a supporting plate on which a flange can be formed. This plate is best made from plastic-coated fiberboard or a similar flat, smooth-surfaced material such as kitchen countertop material available from home improvement stores.

I made my plate with an extra bottom sheet that supports the plug with three wood screws that I can adjust to hold it at the correct vertical position. It's essential that the plug fit perfectly into the support cutout. A perfect fit can never be achieved just by cutting the plate, so you have to cut the opening ⅛ inch larger than the plug all the way around and fill in the gap later.



4 Next, adjust the screws so the plug sits exactly halfway in the plate. Then, treat the plug with a mold-release agent and apply some blobs of auto-body filler to the screws. After curing, the plug will sit firmly in place and rest on the screws.

5 Once you've cleaned the plug, again apply plenty of the release agent to the plug and plate. Don't spare the wax and PVA! Fill in the gap between the plug and plate with auto-body filler and let it cure.

6 When the filler has hardened, carefully remove the plug and sand the filler flush to the plate. When you put the plug back in position, it will fit perfectly in the supporting plate.

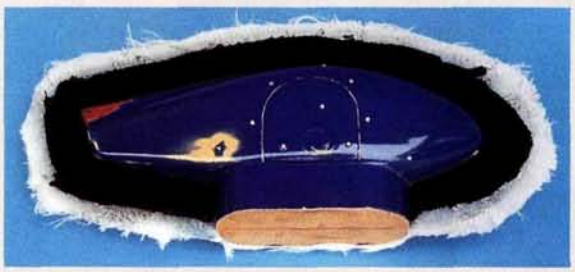
THE FEMALE MOLD

7 Coat the plug and the surrounding support plate with more release agent, and let them dry completely. Mold compound (gelcoat) is stiff, so stir it carefully to mix the base and hardener thoroughly. Starting in the corners, gently brush on the first layer of mold compound with a soft brush. To avoid air bubbles, use a small brush. You'll need to apply two layers for a decent result; brush on the second coat after the first layer has hardened but has not yet fully cured (i.e., it's still sticky). Apply thick layers to avoid retouching the mixture where you've already applied it.

To ensure a firm bond between the mold compound and the epoxy resin, apply cotton fibers, chopped glass strands, or a mixture of both over the mold compound after it has hardened slightly. Once it has cured, remove excess material with a vacuum cleaner.

8 Since you won't be able to force the glass cloth into the mold's sharp corners, you'll have to fill them with a mixture of resin, chopped strands and a thickening agent such as Aerosil. A generous layer of this mixture prevents the cloth from showing through. For best results, use only an aircraft-grade epoxy resin.

9 Build up the mold with layers of fiberglass cloth and try to minimize the amount of resin you use. Once the cloth has been soaked, excess resin doesn't add strength. Add layers of cloth until a rigid mold is formed. For small items such as the plug, the mold wall should be ⅛- to 3⁄16-inch thick, which requires about five layers of 1-ounce cloth. Be sure to apply the cloth to a fairly wide area (about 1 inch) around the plug and on the plate. This provides a good surface against which you'll form the mold's second half.



10 Patience is a keyword in this process! Don't be tempted to remove the mold from the support plate—or the plug from the mold's first half—too soon. Only after everything has completely hardened can you form the mold's second half. Here, the plug and mold have been removed from the support plate. Clean both pieces and liberally coat them with more wax and release agent.

11

12

13

14

15

11—15. Repeat all the previous steps to form the mold's second half: first, the gelcoat/mold compound; then, the chopped strands; next, the generous layer of thickened resin; finally, the glass cloth. In most cases, there is plenty of excess resin to soak into the first layer of glass cloth. Note how the multi-directional cloth easily conforms to the plug's compound curves. Apply the rest of the cloth layers and saturate them with resin until you build up the desired wall thickness.

Once the mold has fully cured—and is still attached to the plug—trim the excess material from the mold halves and drill through the flat flanges. This ensures accuracy when you reassemble the mold to make parts. Now you can remove the halves from the plug. Use some warm water to dissolve the PVA mold release, or use a plastic credit card to pry the mold flanges apart. Don't use metal tools or brute force! Here you see the two halves as they came away from the plug. Pretty smooth!

16

MAKING PARTS

17 Making the actual fiberglass part is basically the same process that you used to make the mold, except that you apply the materials to the inside of the mold instead of over the plug. Start by waxing and applying PVA to the inside of the two mold halves. Although gelcoat is commonly used for the first layer of the part, it's also possible to use a good-quality, epoxy-based paint. This has the added advantage of allowing you to match colors exactly. Here, a single layer of yellow Hobby Poxy* has been brushed on.

18 The starboard half of the mold has two layers of paint, followed by thin layers of resin, cotton fibers and thickening agent. These layers prevent the cloth from showing through the final product, but they need to be very thin to minimize weight.

19 Apply one layer of ½-ounce and one layer of 1-ounce glass cloth to the mold, and blot up any excess resin with a paper towel. The cloth should protrude from the mold by about ¼ inch so the two halves can be joined.

20 Here are both mold halves just prior to being joined together; at this stage, all the materials are still wet. Cut the cloth on one half of the mold flush with the mold flange, and leave the cloth on the other half protruding.

21 To join both halves successfully, lift the protruding cloth slightly, and apply a mixture of resin and fiber strands underneath (about ⅛ inch wide). The cloth will fold inward slightly, as shown.

22 To avoid distortion of the pants after the cutout for the wheels has been made, put two carbon-fiber strips around the cutout's perimeter; This stiffens the structure immensely.

23 Here's the final result as it comes out of the mold, all glossy and shiny. All that's left is to trim the excess resin and the foot of the pant, and you have a perfect, lightweight product. Making your next wheel pant is straightforward and requires only a fraction of the time you'd need to make a wooden one.

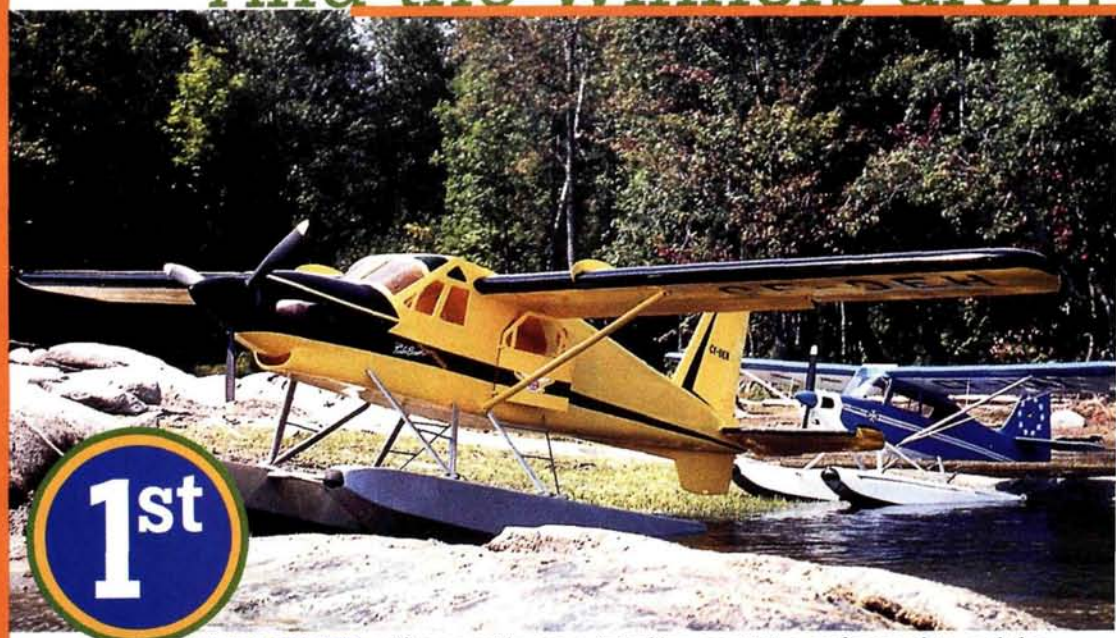
If you are serious about making scale fiberglass parts, then consider making your own two-piece molds. The final product is well worth the effort.

*Addresses are listed alphabetically in "Featured Manufacturers" on page 150.

4TH GREAT RC AIRPL

And the winners are...

All the votes are in, and although the contest was very close, we are pleased to present the winners and runners-up for the 4th Great RC Airplane Design Contest. First announced in our March 2000 issue, the contest drew nearly 100 entrants who supplied photos and written descriptions of their models. Deadline for submission was June 1, 2000. After much thought and consideration, the *Model Airplane News* editors narrowed the field to the top 32 designs and published the finalists in the October 2000 issue. We also asked for readers' help in choosing the winners.



1st

TURBO-BEAVER • After considering originality, creativity, craftsmanship and the votes of our readers, we are pleased to award first place and $1,000 to Don McTaggart of Bobcaygeon, Ontario, Canada, for his 96-inch-span, 1.20, 4-stroke-powered, yellow de Havilland Turbo-Beaver bushplane.

2nd

BOOMERANG • Second place and $750 go to Joseph Colletti of Chalmette, LA, for his 81-inch-span, twin .52 4-stroke Boomerang.

3rd

MILES SPARROWHAWK • Third-place recipient Dick Allen of Endicott, NY, earns $500 for his 88-inch, G-62-powered Miles Sparrowhawk.

NE DESIGN CONTEST

4th

DE HAVILLAND 60GMW • Fourth place and $300 are awarded to Stan Rutz of Muskegon, MI, for his .48, 4-stroke-powered, 60-inch de Havilland 60GMW biplane.

BUNTING 1 • Fifth place and $200 are earned by Henry Haffke of Londonderry, VT, with his ¼-scale, 72-inch, .40-powered Curtiss Wright Bunting I racer.

5th

It is great to see so many talented modelers designing, building and flying original model aircraft, from fanciful sport models to super-detailed scale craft. The future is bright for scratch-builders who are looking for new plans.

As a result of our latest design contest, we look forward to publishing many new and exciting construction articles. To all the contestants and all of our readers who offered their votes, we thank you for your efforts.

***All winners and runners-up receive a* Model Airplane News *T-shirt, and the runners-up also receive a 5-year subscription to* Model Airplane News.**

Congratulations, everyone!

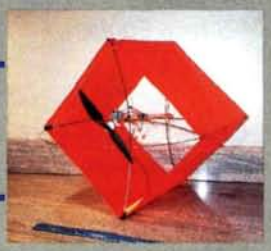
RUNNERS-UP

CAP 10B • One runner-up is Carl Layden of Manuels, Newfoundland, Canada, for his 57-inch, .46-powered CAP 10B.

PROFILE FIGHTER • Also a runner-up is Ray Smith of Marina, CA, for his 36-inch Profile Fighter slope soarer.

SUPERMAN • Another runner-up is the "Man of Steel," Gerard McHale of Summerland, British Columbia, Canada, for his .61-powered, 6-foot-tall Superman!

FLOATING CUBE • Lance Liotta of Bethesda, MD, is a runner-up for his electric-powered Floating Cube.



FOAM STUKA • Our final runner-up is Keith Sparks of Fort Worth, TX, for his 58-inch, .32-powered Foam Stuka.

MODEL AIRPLANE NEWS
HOW TO

Easy ducted-fan engine hop-ups

Get 20 percent more power!

by Robert Thacker

Col. Robert E. Thacker with his F-15 "Active" based on NASA's experimental Eagle. His model uses a Tom Cook fan unit with a K&B .82 engine and Byron fuel.

To paraphrase Mark Twain, reports of the demise of the ducted-fan powerplant for jet model airplane use have been greatly exaggerated. The introduction of top-of-the-line turbines in the last few years has by no means eliminated the high-revving, 2-stroke engine for the majority of us model builders. Two-stroke powerplants have fascinated me since 1932, when I got a ⅕-horsepower Brown Jr.—quite different from the 2-stroke power that's available now!

In fact, if you've been thinking about getting into jet modeling, now is the perfect time because there are many kits, fans and engines available. I bought this new K&B* .82 and Dynamax* fan setup via the Internet at two-thirds the retail cost. A lot of horsepower has been built into this K&B engine, and it's a good, reliable powerplant out of the box. Remember, though, that modifying an engine for increased power comes at a cost: longevity. Engines have only so much horsepower in them; you can use it all up in 100 flights, or you can use it all up in 250 flights. I prefer 250, and that's why I modified the K&B .82 only slightly.

All of the modifications I describe originated with model boat racers such as Bobby Tom and Steve O'Donnell, and folks who have run high-performance motorcycle engines for many years.

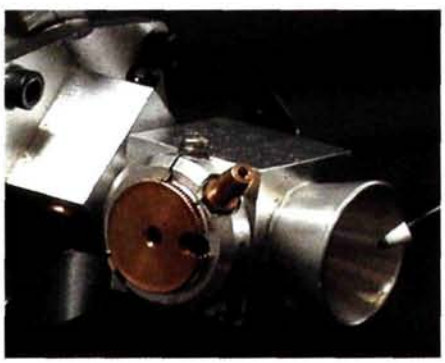
The stock K&B .82 engine and Dynamax fan and shroud are a good, reliable power system for a ducted-fan jet, but a few simple modifications to the engine can increase performance by 20 percent!

TESTING THE ENGINE

The object was to determine how we could improve the horsepower of a brand-new K&B .82 ducted-fan engine and Dynamax shroud and fan. Let's discuss the K&B .82. It is a very fine engine that now comes with a redesigned carburetor with a larger throat (0.466 inch). The idle mixture has also been completely changed from its previous version.

The engine came with its idle mixture perfectly set; I didn't even have to touch it. The mixture can also be adjusted with a hex wrench, which means a lot to us old-timers! Of course, the engine comes with a drum valve instead of a disc valve and will give you more power right off the top.

For testing, I used a Pro-Tac tachometer and Byron* 5-, 10- and 20-percent nitro fuel augmented with 5 ounces of Klotz* Bean Oil except where noted. The barometric pressure was 29.92; temperatures were in the 70- to 75-degrees Fahrenheit range. Tests were made with the fan, engine and tuned pipe but without the exhaust tailpipe. Pipe pressure was used on all runs.



The new carburetor with the enlarged throat and new idle mixture disc.

• **Test 1.** This really wasn't a test; I set up the engine on the stand and broke it in with 10-percent nitro. When it held a steady rpm, I started the engine runs. The pipe was an 11¾-inch, Mac's Products* QT. It tached a solid 21,200rpm—very nice.

• **Test 2.** I took the QT pipe off and installed a straight, 12¼-inch nitro pipe; we tached it at 21,900rpm. On this run, I blew the K&B plug that came with the engine. I replaced it with my favorite—the world standard McCoy* no. 9—and had no further plug problems.

• **Test 3.** I chamfered the sides of the Schnuerle ports and reattached the Mac's QT pipe. The engine ran 21,450rpm—a nice 250rpm increase from the first run!

• **Test 4.** On the fourth run, the engine provided 22,000rpm with the straight nitro pipe. Up 550rpm—good!

• **Test 5.** I opened the exhaust port on the

sleeve from 0.373 to 0.400 inch, and the engine ran 22,200rpm (with the nitro pipe).

• **Test 6.** On the sixth run, I tried Byron 20-percent nitro fuel with no added Bean Oil. I tached the engine at 22,500rpm.

• **Test 7.** With 20-percent nitro and a Mac's QT, the engine ran 21,950rpm.

• **Test 8.** I changed fuels with 5-percent nitro on the eighth run and measured 21,500rpm.

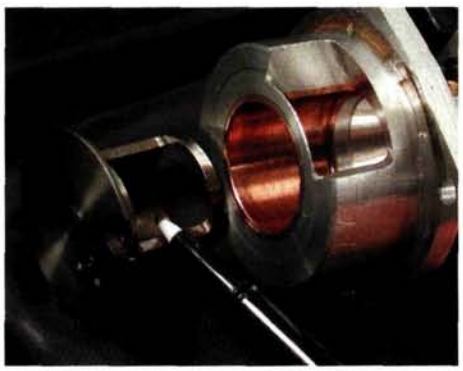
• **Test 9.** On the ninth run, I modified the engine again by lightening the piston. This also allows the mixture to cool the top of the piston a little better than normal. With the lightened piston, the engine ran 21,750rpm. That alone gave a boost of 250rpm!

• **Test 10.** The 10th run was the same as above but with a nitro pipe. The engine ran 22,500rpm—not bad.

• **Test 11.** To top off everything, on the 11th and final run, I put 20-percent nitro in, and the engine ran 22,750rpm. That raised the horsepower of the engine from 4 to 4.8. That's better than a 20 percent increase. Why did we get such a boost with only 1,550rpm increase? Horsepower goes up by the square of the rpm.

Left: the left side of the sleeve, looking at the exhaust end of the engine. The left port is contoured so that it shoots the air to the front and top of the sleeve. Right: the sleeve before modification (left) and after. I've domed it at the top, just like Nelson does on his engines.

Left: I modified the exhaust port by increasing the timing to about 185 degrees. The sleeve is upside-down, and I used a Dremel tool with sort of a beveling sweeping action to open up the port. The brass sleeve is very soft; sand it with 600-grit paper, from the inside outward, to remove any remaining chrome burrs. Right: the sleeve is right-side up, and I'm contouring the intake ports to allow the incoming air to go to the front and top of the sleeve. Fuel that goes out the exhaust is wasted.



Left: the new drum valve on the latest version of the K&B .82 is beautifully machined! Right: the piston modification lightens it and also allows the piston to run cooler. Remember: that piston modification is on the front of the piston where the boost ports are, not in the rear of the engine where the exhaust ports are.

OVERVIEW

I ran 20-percent nitro with no problem whatsoever. That indicates to me that the engine's compression is too low. If you want, you can take the engine to a machinist who can increase the compression ratio by dropping the head down and making the squash band a little bit tighter. My engine is measured right at 0.0027 inch. You can bring it down to about 0.0022 inch and then play around with head shims. If you don't blow a few plugs, then you're not using enough nitro or the engine's compression ratio is too low. You can probably get a little more power out of your engine by slightly increasing the compression ratio.

The upright sleeve and exhaust port opened up to 0.04 inch.

I'm not recommending that you run a straight nitro pipe; however, if you want the whole nine yards, go ahead! That pipe is incredibly loud, though, and running 20-percent nitro can be expensive. I'm going to run a stock Mac's QT with 10-percent nitro and with the internal modifications I've just described. The K&B .82 will give you a stellar performance with an aircraft that weighs between 10 and 14 pounds.

Remember to add Klotz Bean Oil to your fuel and use blue Loctite* on everything except the head bolts. Notice how beautifully clean the engine is, inside and out; good fuel like Byron's and Klotz is well worth the cost. See you at the field!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.* ✈

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

RC system battery manager

CIRRUS
Cycle Pro

by Gerry Yarrish

The Cirrus Cycle Pro is a battery management system for commonly used Ni-Cd battery packs. The Cycle Pro has two circuits (A and B) and two outputs that will charge and discharge 1-, 4-, 5-, 6-, 7- and 8-cell battery packs at two different current rates. The system uses delta-peak charging technology so that the circuitry looks for a drop in voltage of 1.05 volts per cell before it switches off the rapid charge rate. For a charge rate you have the choice of either 500 or 1000mA and a discharge rate of 250 or 750mA. Input voltage is 12V, and the system comes with its own AC voltage supply so it can be used either at the field (a cigarette lighter adapter is included) or at home on the workbench. The system also includes banana clips for making your own charging leads.

The Cirrus Cycle Pro is a 12V DC battery management system with two separate charge circuits.

SPECIFICATIONS

Product: Cirrus Cycle Pro

Distributor: Global Hobby Distributors

Type: Battery cycler/charger

Input power: DC (110V AC converter included)

Output: DC (two circuits) for 1, 4, 5, 6, 7, or 8 cells

Charge rate: 500 or 1000mA (selectable)

Discharge rate: 250 or 750mA (selectable)

Function: Peak detection, fast, or trickle charge with 1 to 5 charge/discharge cycles

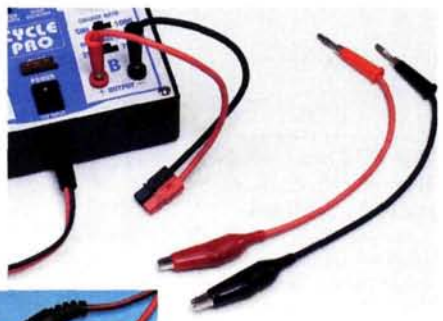
Street price: $139.99

Comments: the Cirrus Cycle Pro is two chargers in one with its twin charging/discharging circuits in one case. The unit is microprocessor controlled and comes with an AC/DC converter so it can be used both at the field (with included cigarette lighter power adapter) and in the shop. The cycler uses delta-peak detection and can cycle your battery pack up to five times at selectable current settings. The big LCD display indicates voltage, amp rating, charge and discharge times and number of cycles left.

The Cycle Pro also has an LCD display that shows several charging parameters for either the A or B circuit, including pack voltage, charge time, mAh, discharge time and the number of charge/discharge cycles. You can select from 1 to 5 cycles, or you can simply charge a pack one time by pressing the required buttons. Green and red LED indicator lamps glow steady to show whether the selected circuit is charging (green) or discharging (red). The green LED blinks when the cycle or charge is complete. You must cycle a pack at least twice to get an accurate reading of its mAh condition. For the most accurate reading, you should "deep cycle" the pack to remove any voltage "memory." This is done by cycling the pack five times at the lowest current setting (500mA). If after cycling the pack reads less than 80 percent of its indicated rating, the pack should be considered suspect and replaced.

When charging a single cell of any size, use the lowest current setting. Because the lowest current setting is 500mA, the Cycle Pro may not provide 100 percent accurate ratings for batteries with less than 250mAh capacity. For charging RX and TX battery packs, Global* offers separate charge leads for JR- and Futaba-compatible radio systems.

If you want the most out of your Ni-Cd battery packs, you need to cycle them and monitor their performance. With a street price of $139.99 (charge leads cost $9.99), the Cirrus Cycle Pro makes it easy to do.



Above: the Cycle Pro comes with banana-style clips so you can make your own charging leads like the ones shown here. You supply the wire and matching connector for your battery pack. Left: Global offers separate charge leads for use with JR, Futaba, Airtronics and Hitec radio systems.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 150.* ✦

 by Gerry Yarrish

Model size, wing area and power loading

Regardless of the size of the airplane we build and fly, it needs a certain amount of power to perform as it was intended to. When we build a model or assemble an ARF, we know going in the size of the engine it will need for power. But what if we design and scratch-build a model for the first time? Several readers have asked how to determine how much power is needed for a given airplane. Let's look at some of the considerations for determining proper engine size and power, relative to our model's size.

Roy Vaillancourt's 35-pound Tempest is powered by a Quadra Q-75. With a power loading of 11.6:1, it has impressive performance.

HOW MUCH IS ENOUGH?

Before you can ask the question, "How much power do I need?", you first have to determine how big your model will be and what its wing loading will be. Wing loading is the ratio between the model's weight (in ounces) and its wing area (in square feet), and it's important because it directly affects the model's stall speed. The heavier the model, the higher the wing loading and stall speed will be, given the same-size wing.

My usual rule for sport-model wing loading is to stay between 20 and 30 ounces per square foot. For a light model, such as a Piper Cub, Taylorcraft, Aeronca Champ, etc., the loading is at the lighter side of the range. WW I models also fall into this group. Higher-performance models, such as CAP 232s, Extra 300s, etc., will be at the higher side. Very large, high-performance aircraft and fighters—Mustangs and Thunderbolts—will perform very well with wing loadings of 40 ounces per square foot (or more). A convenient formula that will keep your model in a safe wing-loading range is to maintain one pound of model weight for every 100 square inches of wing area. This works out to a very comfortable 23 ounces per square foot. Most plans give a projected model weight, so check your plan for a starting point.

This Grumman Avenger torpedo/bomber, built and flown by Nick Ziroli Jr., flies very realistically. A hefty 45 pounds, the plane has a 4.2ci gas engine for power; its power loading is 10.7:1.

POWER LOADING

Once we have the general weight and wing-area figures, we need to apply them to a given horsepower to arrive at a power-loading value. I first learned about power loading (PL) when I read the book, "Giant Steps" (1980). In it, Don Godfrey offers a good rule for engine/aircraft matchmaking: never exceed 12 pounds of model weight for every cubic inch (ci) of engine displacement. This is very general and does not account for the model's aerodynamic sleekness or the efficiency of the engine/prop combination, but it gives us a model-weight-to-engine-ci ratio of 12:1. I also found it interesting that this ratio is somewhat confirmed by the long-standing, electric-model performance requirement of 60 watts per pound of model weight. Since 746 watts equals 1hp, then the 60W/lb. rule equates to a 12.4:1 PL. Close enough for me!

How does horsepower relate to engine displacement? For a very general and conservative equation, I use one horsepower (hp) for every cubic inch of engine displacement (for 2-stroke gasoline engines). Some 2-stroke and 4-stroke glow engines can produce more than this, but to keep it simple, I always use the 1:1 ratio. This gives values of 1.3hp for a Zenoah* G-23, 2.5hp for a G-38 and 3.7hp for a G-62—pretty close for estimations.

FIGURE 1. AIRCRAFT POWER-LOADING COMPARISON

Aircraft	Span (inches)	Weight (pounds)	Wing area (square inches)	Wing loading (ounces/square foot)	Engine (horsepower)	Stall speed (mph)	Power loading (weight/hp)
Balsa USA ¼-scale Cub	108	15	1,610	21.47	1.2	17.14	**12.5:1**
CGM Decathlon ARF	80.75	10	969	26.10	0.90	18.9	**11.1:1**
Balsa USA ⅛-scale Cub	140.75	35	3,051	26.43	3.7	19.02	**9.45:1**
Sig CAP 231 ARF	73	10.5	962.5	25.13	1.2	18.55	**8.7:1**
Dave Patrick Ultimate Bipe	60.5	10	1,230	20.56	1.20	16.78	**8.3:1**
Dave Patrick Extra 300	76	11	1,205	21.03	1.50	16.97	**7.3:1**
Hangar 9 CAP 232	72	11	1,031	27.61	1.5	19.44	**7.3:1**
Uravitch ⅛-scale Fokker D-VII	75	18	1,748	23.73	2.5	18.02	**7.2:1**
Great Planes P-47	85	21	1,327	36.46	3.0	22.34	**7:1**
GSP.com Staudacher	90	23	1,415	37.48	3.7	22.64	**6.2:1**
Ziroli P-47 Thunderbolt	70	14	900	38.34	2.5	22.91	**5.6:1**

Left: this Top Flite Stinson Reliant weighs 20 pounds and uses a U.S. Engines 41 for power. It flies beautifully with a power loading of 8.3:1. Below: powered by a 2hp engine, this 23-pound Pfalz D.111, built and flown by Tom Polapink, has a power loading of 11.5. Tom flies this model very realistically.

It then follows that if you want better performance from your models, you have either to increase power or decrease weight. Several aircraft on the market today have much higher PL values. These are aerobatic aircraft and have impressive vertical performance. For some basic PL comparisons, see Figure 1.

Here is a sample computation for my newest project, a 22.5-percent-scale, Miles M-18 R.A.F. primary trainer. The Miles has a wingspan of 85 inches and roughly 1,275 square inches of wing area. I estimate a ready-to-fly weight of 15 pounds. This gives me a 27.10 ounces per square foot wing loading. Using a PL as low as 10:1, I can assume that I will need roughly 1.5hp to fly the model in a scale manner (on the wing). A Saito* 1.50 4-stroke or an RCS* 1.4ci gas engine should work out nicely. I'm not suggesting that other engines won't work as well or better, but I do know that my engine choices will work.

Using some basic power-to-weight ratios, you can be confident that the engine you choose will get your model safely off the ground and fly it properly. By also having your model's wing loading at an acceptable value, you know that your model will be able to land safely at a reasonably low airspeed.

GAS ENGINE GOODIES

Horizon Hobby Distributors* has been offering the Zenoah engine line for a long time, and these engines have a good reputation for power and reliability. I have several

Right: Greg Hahn's SBD Dauntless dive-bomber is powered by a Zenoah GT-80 (4.8ci) and weighs 45 pounds. The model has a power loading of 9.3:1.

Below: this Balsa USA Eindecker, powered by a Saito .90 4-stroke engine, weighs 9.5 pounds and has a power loading of 10.5:1—very realistic performance.

The new Horizon starter pack is a good way to make sure you treat your gasoline engine properly. The kill switch plugs directly into the magneto wiring, and the synthetic, 2-cycle oil provides good engine protection. And you gotta love that big, calibrated mixing cup!

Zenoahs in my inventory. Recently, Horizon came out with some neat little items to make your gas engine installation and operation more convenient. In its starter pack, Horizon offers a synthetic, 2-cycle fuel-mix oil, a prewired kill switch, fuel-line accessories and a calibrated measuring cup.

I've used these items recently, and they work well. The ignition kill switch comes with bullet-style wire connectors, and they plug directly into the magneto wire on Zenoah engines—very easy indeed. The fuel filter and fuel-dot hardware come with a molded T-fitting so you can run a 2-line fuel system. By cutting the fuel line leading from the tank to the carb and inserting the T-fitting, you can fuel and de-fuel the model without removing the fuel line or using a third line. A line attached to the T-fitting leading to the fuel dot makes for a very neat and easy setup.

The new measuring cup is a long-needed accessory. I have used old oil cans and containers that had calibration lines molded into their sides to measure oil mixes, but the new cup is big and well-marked. I have both one- and two-gallon fuel cans, and using the cup, I can quickly mix the proper ratio of oil into my gasoline for either size of can. It may not be very high tech, but I like the measuring cup a lot.

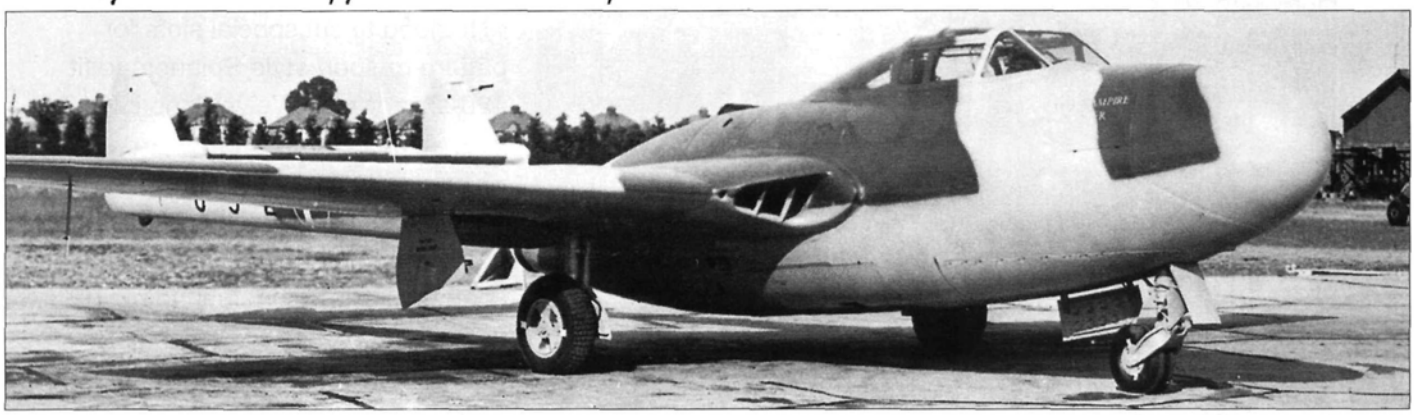
That's it for this month. If you have any questions or comments, please write to me at "Thinking Big," c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877, or email me at man@airage.com. Remember: keep thinking big.

** Addresses are listed alphabetically in "Featured Manufacturers" on page 150.*

NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.



Congratulations to Bill Finney of Muncie, IN, for recognizing the Swee' Pea as our January mystery plane. The Swee' Pea was a Goodyear Trophy racer designed by Art Chester (that's Chester in the photo), and of the many correct responses we got this month, Bill's was among the most detailed. The Swee' Pea first raced in the 1947 National Air Races, finishing second, and it was, at the time, the only racer with a butterfly (V) tail. The plane cost an estimated $5,000 when new, and it was 15 feet, 6 inches long with a 17-foot, 5-inch wingspan. It weighed just 520 pounds empty, and its 85hp C-85 Continental engine allowed a top speed of nearly 200mph. It was campaigned again in 1948 with some subtle modifications.

The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

MODEL AIRPLANE NEWS CLASSIFIEDS

RATES: non-commercial—25 cents per word (no commercial ads of any kind accepted at this rate); commercial—50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.** To run your ad for more than one month, multiply your payment by the number of months you want it to run. Deadline: the 10th day of the month, 3 months in advance, e.g., *January 10 for the April issue.* We don't furnish box numbers, and it isn't our policy to send tear sheets. Please make all checks payable to: Air Age, Inc. Send ad and payment to: CLASSIFIED ADS, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA, or call (203) 431-9000.

BUSINESS

B.J.'S MODEL ENGINE SERVICE. No time to do your own engine repairs? I apply my 40 years' experience in the hobby to servicing your engine as carefully as you would yourself, if you had the time! All makes and sizes, 2- or 4-stroke, gas or glow, plane, boat and car: $20/hr. plus parts (you may supply parts), plus shipping at cost ($5 min.). For cost estimate and backlog—usually 2 to 3 weeks, plus transit time—call first. Bill Jensen, B.J.'s Model Engine Service, 36 Macintosh Dr., Oxford, CT 06478; (203) 888-4488, fax (203) 888-3255; email WbillJensen@cs.com. [5/01]

ALUMINUM CAN PLANS. Build airplanes, vehicles. Free list. Tesscar, Box 333A, Scappoose, OR 97056, or www.tesscar-aluminum-craft.com. [8/01]

NEW ZEALAND AERO PRODUCTS. Scale plans: Piper Pawnee, Pawnee Brave, Cessna Agwagon, 152 Aerobat, 206 Stationair, Transavia Airtruk/Skyfarmer, Fletcher FU-24, Douglas DC-3/C-47, Rearwin sportster and more. Hardware paks, colour photo paks, free documentation. Catalog/price list: $5 (U.S.); Visa/MC. Check out our website: www.newzealandaeroproducts.co.nz, 34 Ward Parade, Stirling Point, Bluff, New Zealand. Phone/24-hr. fax: 643-212-8192. [2/02]

BUILD WARPLANE WINDVANES! Free info: Windmodel, 520 Hooper Rd.-153, Endwell, NY 13760-1960; (206) 350-1320; www.windm.com. [2/01]

QUARTER-SCALE "FLEET MODEL 2" and ⅙ Electric Fleet kits. Concept Models, 2906 Grandview Blvd., Madison, WI 53713. SASE for details. www.mailbag .com/users/conceptmodels/. [6/01]

MAKE YOUR OWN ROCKET MOTORS!!! Homemade solid and composite fuels power RC gliders, model rockets, etc. Smoke tracers for RC planes and choppers, electric igniters, cannon fuse "chemicals," lab acids, glassware, "how to" books, videos and rocket motor kits. HUGE catalog, $2. Pyrotek, P.O. Box 300, Sweet Valley, PA 18656; (570) 256-3087; www.pyrotek.org. [6/01]

RYOBI CONVERSIONS. We are the oldest, the best and least expensive. For complete engines, conversion kits, or our 360-degree muffler, we have all your conversion needs. For free conversion instructions and catalog, send SASE to Jag Engines, 16073 Muscatel, Hesperia, CA 92345; (760) 244-7270, or see our website at http://www.jagengines. com. [3/01]

PLANS. RC sailplanes, scale, sport, electric, Old Timer, Nostalgia. All illustrated. Catalog, $2. Cirrus Aviation, Box 1375, Nanton, AB, CanadaT0L1R0. [3/01]

MODEL PLANS AND 3-VIEWS. Thousands available—OT—scale—FF—UC—rubber; enlarged or reduced to any size. SASE for free info. Roland Friestad, 2211B 155th St., Cameron, Illinois 61423; email - "Box B"<cardinal.eng@gallatinriver.-net> [3/01]

MODEL AIRPLANE MALL
Modelairplanemall.com
Modelairplanemall.com
Modelairplanemall.com [8/01]

GAS ENGINE CONVERSIONS, KITS AND PARTS—Homelite, Weedeater, Ryobi, McCulloch, Honda. Infor-mation, $5. Visa, MC. Carr Precision, P.O. Box 20404, Keizer, OR 97307; phone/fax (503) 304-7195. Email carrprecision @worldnet.att.net; http://www.carrprecision.com. [3/01]

BOB'S AIRCRAFT DOCUMENTATION AND RESOURCE GUIDE 2000. World's largest commercial collection of aircraft photos (400,000) and 3-view line drawings (35,000). 242-page catalog, $8 (Canada, $10; foreign, $18). 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [3/01]

WANTED: ALL TOY METAL OUTBOARD MOTORS. Electric, wind-up and gas. Also wanted: .60-size spark ignition motors, thimble drone, etc., racecars. Call Richard, (231) 941-2111. [6/01]

OTT-LITE TRUE COLOR LAMPS FOR YOUR SHOP! Bright, glare-free, perfect for color matching, CRI = 95. Bring full spectrum daylight illumination inside! Discount prices! (800) 742-4289; www.lumenlight. com. [3/01]

MODEL AIRPLANE NEWS: 1930-1980. "Air Trails," 1935-1952, "Young Men," 1952-1956, "American Modeler," 1957-1967, "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, BC Canada V0R 1L1. [7/01]

HOBBYIST

USED ENGINES WANTED: pre-1970 preferred. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [4/01]

LOOKING FOR A LEICA OR HASSELBLAD CAMERA OUTFIT (working or not). (702) 293-7800. Virgil Fredriksen, P.O. Box 60781, Boulder City, NV 89006. [3/01]

Featured Manufacturers *The following manufacturers' products are featured in this issue.*

3 Sea Bees Models, P.O. Box 747, Lake Stevens, WA 98258; (425) 334-6089; fax (425) 397-2126.

Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7766.

Airtronics, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540; www.airtronics.net.

Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182; (732) 225-6144; fax (732) 225-0091; www.modelrec.com.

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BY JAMES FROLIK

Russian space shuttle and mothership

Over a decade ago, the Soviet Union built the world's largest airplane—the Antonov An-225 Mriya—and four Buran space shuttles. In 1988, an unmanned Buran was boosted into space on an Energia rocket and completed two earth orbits before returning for a perfect landing. But subsequent economic turmoil caused the cancellation of the entire Soviet shuttle program, and the Russian government retired the orbiters to static display; one is on temporary exhibit at Sydney Harbour, Australia. The sole An-225's primary role was to transport the shuttles, but it has since seen little activity besides being used to haul ordinary cargo.

Along came Hans Bühr of Winkel, Switzerland. Already one of Europe's foremost electric-ducted-fan aeromodeling pioneers, he wanted to give Mriya and Buran their due recognition. In 1995, shortly before his retirement from Swissair as a Boeing 747 captain, Hans began to design his own An-225 model. The Russian word "mriya" roughly means "dream," and it's very appropriate considering Hans' vision: he wanted his model to be big—like a tribute. He started construction in October 1995, and some 600 building hours later, the model Mriya made its first flight in February 1997.

Following impressive European appearances, including the 1997 Jet World Masters in England, Hans began shuttle construction in 1998. Buran, which translates as "snowstorm," first flew piggyback atop the An-225 in March 1999; that June, the model orbiter's first solo flight was at a show in Aiolo, Italy. Hans piloted the Antonov while his friend Peter Rütimann piloted the orbiter, and they repeated the performance two months later at the 1999 Jet WM in Austria. The models always amazed the crowds. "This configuration," said Hans, "is something that fascinates the model builder because many don't believe something like this can get in the air and actually function."

Both models are 1/25 scale and essentially of all-foam construction. Hans sandwiched the Antonov's foam wings between balsa sheeting, and the tail section is also balsa and foam. Each model has an internal fuselage frame of balsa tube covered in Kevlar and sealed with finishing epoxy. These superstrong tubes have an 11/16-inch diameter, weigh roughly 1 ounce per meter and support internal components and landing gear. The Antonov has a 138.75-inch wingspan, is 137.25 inches long and weighs 26.4 pounds; the shuttle has a 37.9-inch wingspan, is 55.3 inches long and weighs 3.3 pounds.

The An-225 uses 12 servos and two receivers. Controls are aileron, elevator, rudder, motor, flap, ground steering, landing lights and retractable landing gear. A piezoelectric gyro stabilizes its pitch, and several mixing functions also double as backup control systems; e.g., in an emergency, the flaps or split elevator can double as ailerons.

Its six engine nacelles are fiberglass, and each houses a homemade carbon-fiber fan with 90mm diameter and a 5-blade, 6-inch-pitch rotor. Power is from brushed Lehner 2718/20 NL motors and two parallel power systems. Each system uses three motors wired in parallel and is connected to a homemade speed control. Each controller is connected to a separate 24-cell 1700SCRC battery; full-throttle current is 12 amps per motor at 18,300rpm. This allows flights of five minutes plus reserve power for a few missed approaches.

The Buran is a "glider," so landing it involves a one-shot final approach. One servo releases the orbiter from a mooring platform atop the Antonov. Two piezoelectric gyros stabilize the roll and pitch axes by assisting four aileron and elevator servos. The landing gear is manually retracted prior to flight, and a sixth servo extends it into a locked position before it lands.

The photos were taken at a show in Hausen am Albis, Switzerland, in October 2000. Bad weather restricted the models to one flight, and just before flight time Hans discovered a faulty battery in the shuttle's transmitter. Unfortunately, that precluded any shuttle separation because he had no replacement cell. Nevertheless, he elected to fly one piggyback flight for the crowd and cameras. Nobody complained. Snowstorm or not, the crowd of some 1,000 spectators was left dreaming.

Find more information about Mriya and Buran on the Internet at www.air-and-space.com/ruslan.htm and www.rocketry.com/mwade/craft/buran.htm.